



Light and Color in Funerary Architecture

Jacqueline Lin

A thesis booklet submitted in partial satisfaction of the requirements for the degree of Master of Architecture in the Graduate Division of the University of California Berkeley

The thesis of Jacqueline Lin titled Light and Color in Funerary Architecture is approved by



05/21/2021

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Date



05/21/2021

Eleanor Pries

Date

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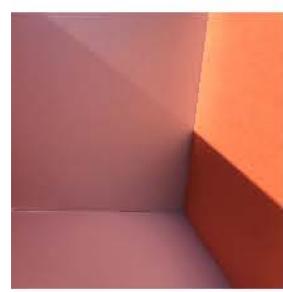
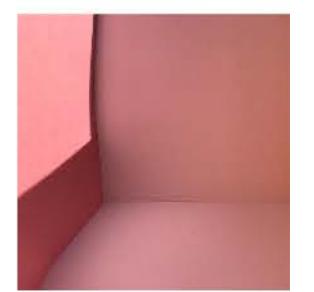
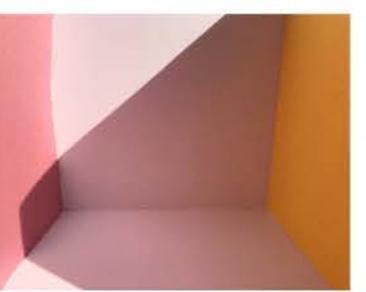
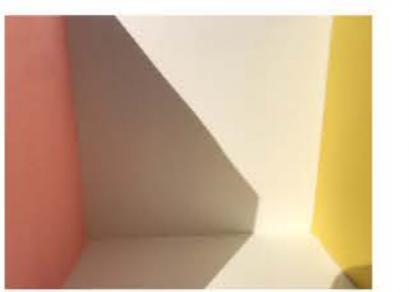
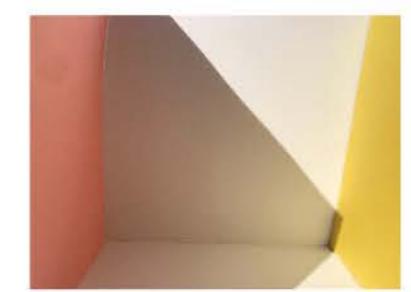
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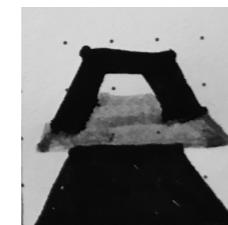
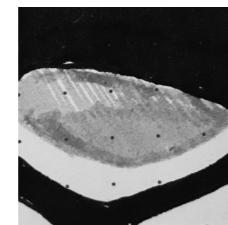
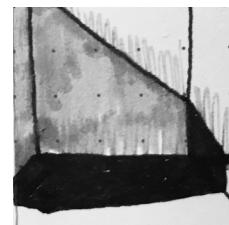
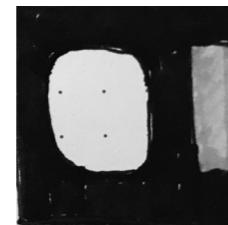
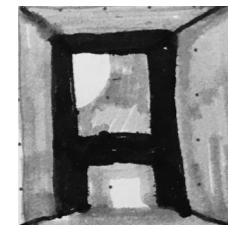
Background

[Light and Color]

The sun master of our lives
far off indifferent
He is the visitor – an overlord
he enters our house
In setting he says good evening
to this mossy earth (oh trees)
to these puddles everywhere
(oh seas) and to our lofty
wrinkles (Andes, Alps and
Himalayas). And the lamps
are lit up.
Punctual machine turning
since time immemorial
awakens every instant of the
twenty-four hours the gradation
the nuance the imperceptible
almost providing
a measure. Yet brutally
he breaks it twice –
night and day – these two phases
rule our destiny:
A sun rises
a sun sets
a sun rises anew

“The Poem of the Right Angle”
Le Corbusier

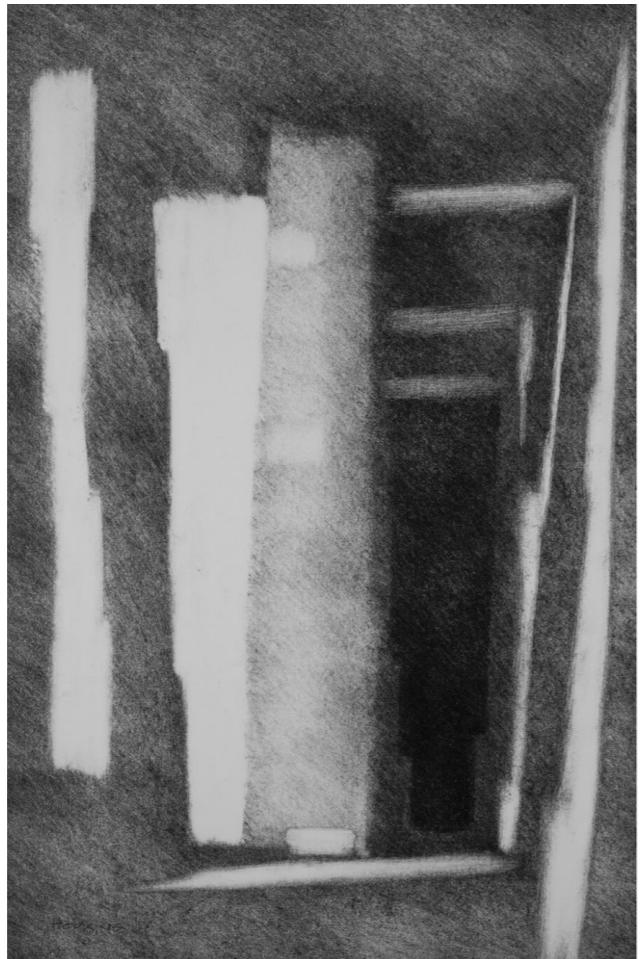




Sketches of Light and Shadow

"An age old ingredient of sacred space- shadows are able to stir the subconscious, and lure the faithful into a state of reverie"

Henry Plummer



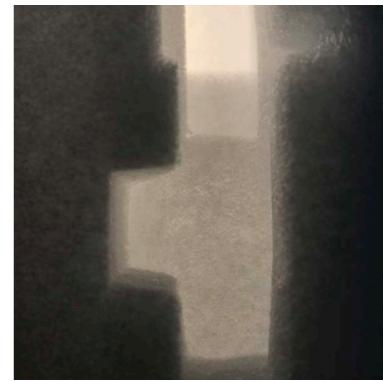
Point de Repos, Les Carrières, Limestone Quarries, monotype
John Hopkins

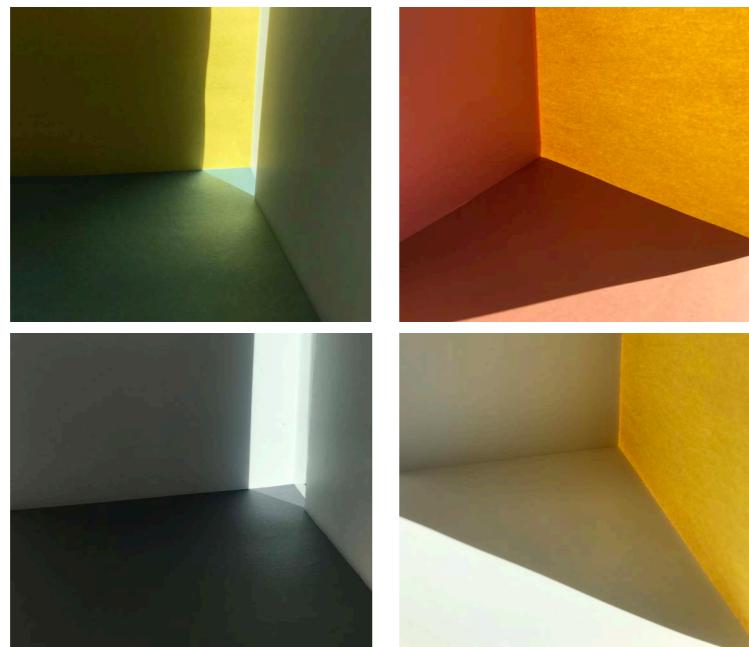
"Plan a building as a pure mass of shadow then afterwards to put in light as if you were hollowing out the darkness, as if the light were a new mass seeping in"

Peter Zumthor



Study model made with styrofoam packing and a swing lamp





Study images of direct sunlight and colored shadow

“Architecture is a art when one consciously or unconsciously creates aesthetic emotion in the atmosphere and when this environment produces well being.”

Luis Barragán

Background

[Funerary Architecture]

This thesis explores the use of natural light and color to transform death in urban and daily life. The following funerary precedents were integral to the design and conception of this thesis program.





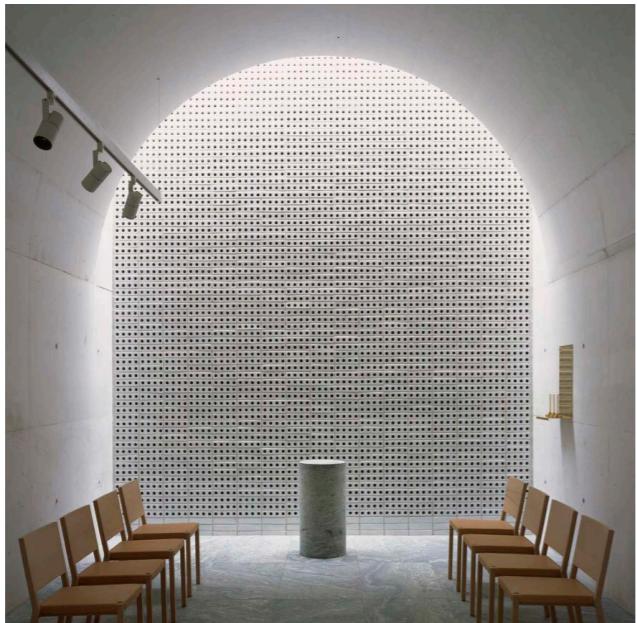
Igualada Cemetery, Barcelona, Spain, 1994

Estudios Carme Pintos



Tanatorio Municipal de Leon, Leon, Spain, 2000

BAAS



Woodland Cemetery, The New Crematorium, Stockholm, Sweden, 2013
Johan Celsing Arkitektkontor



Crematorium Bauschulenweg, Berlin, Germany, 1998
Shultes Frank Architekten



Water Temple, Awaji, Japan, 1991

Tadao Ando

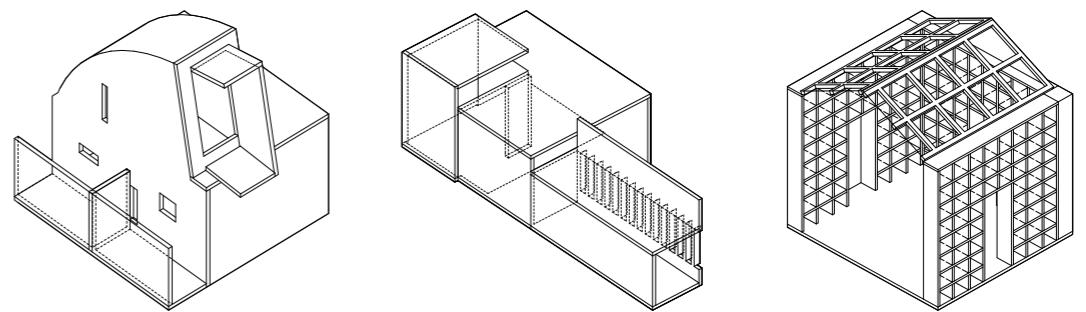


Day of the Dead Offering in San Miguel de Allende, Mexico

Precedent Models

[Test Models]

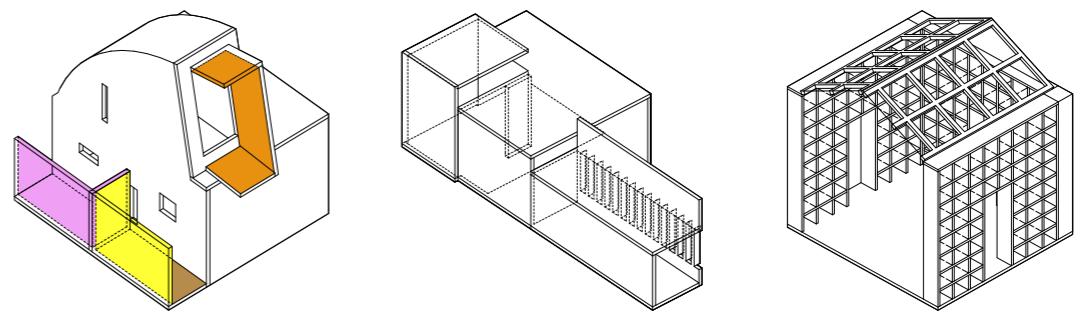
I built 3 precedent models, “to test, refine and illustrate” concepts of light and color in architecture.

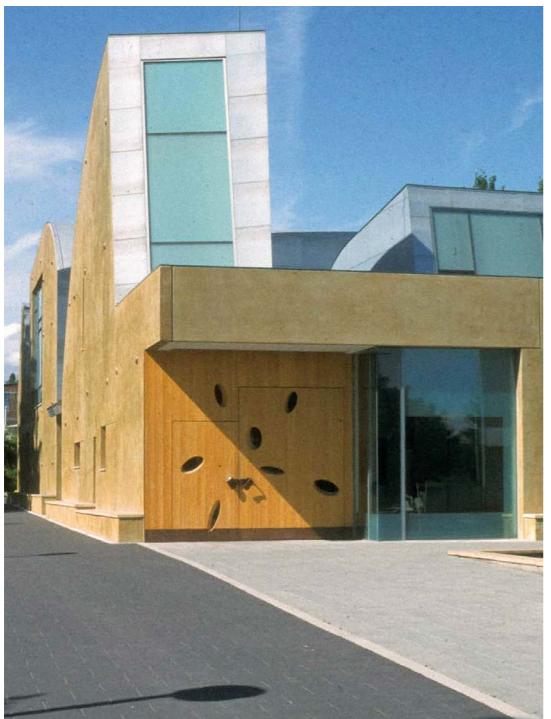


Precedent Models

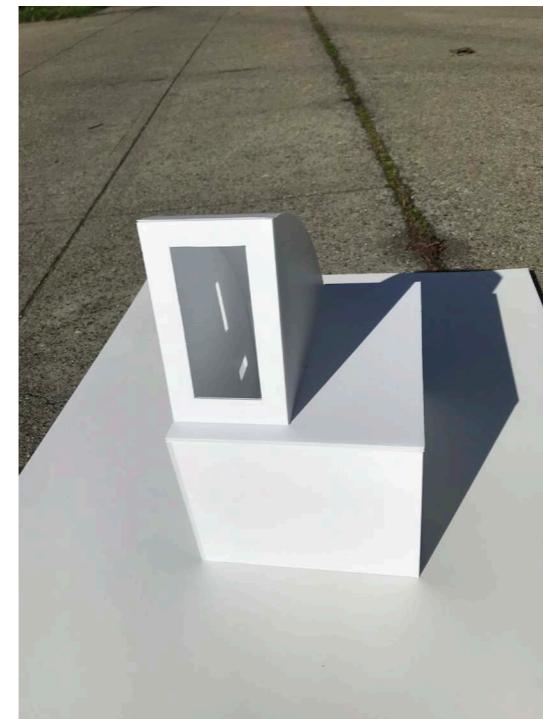
[Chapel of St.Ignatius]

I looked at the Chapel of St.Ignatius by Steven Holl, modeling this light scoop and small window openings. Then, I added "color goggles" to test out if color could reflect or enter the space. Simply by rotating the model in different orientations, views of the color beyond change the experiential quality of the space.

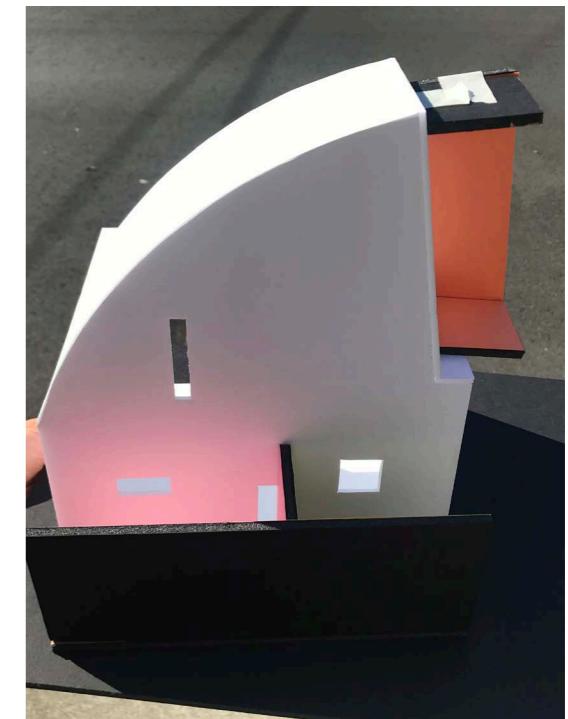


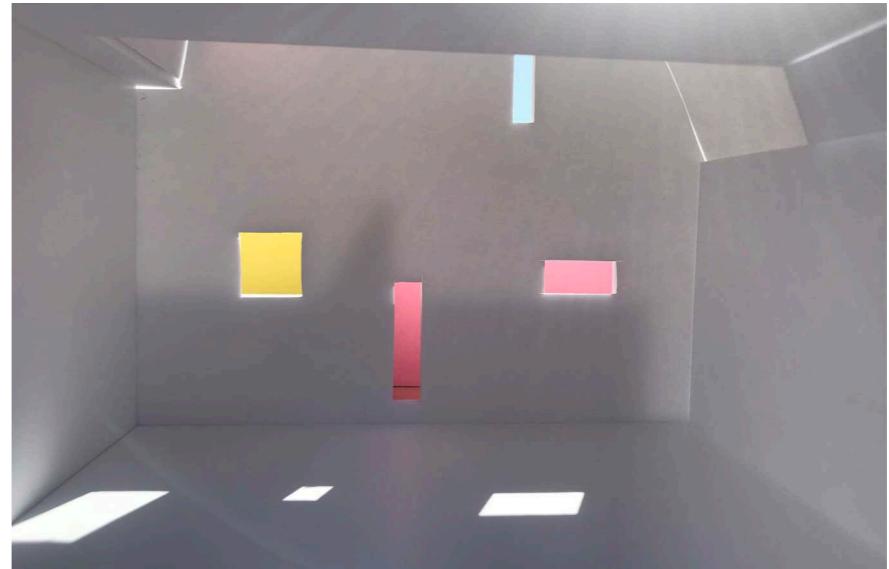
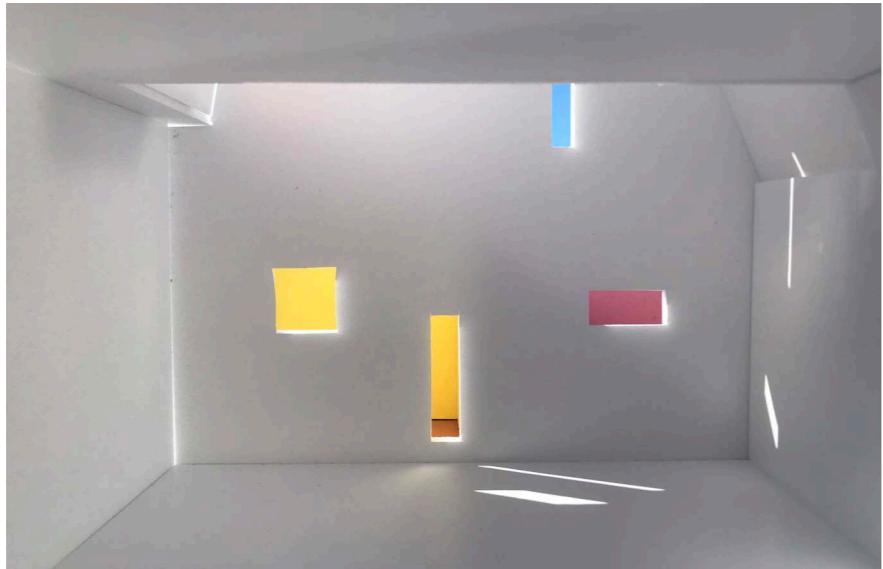


Chapel of St.Ignatius, Steven Holl



Color Goggles, Chapel of St.Ignatius, Steven Holl



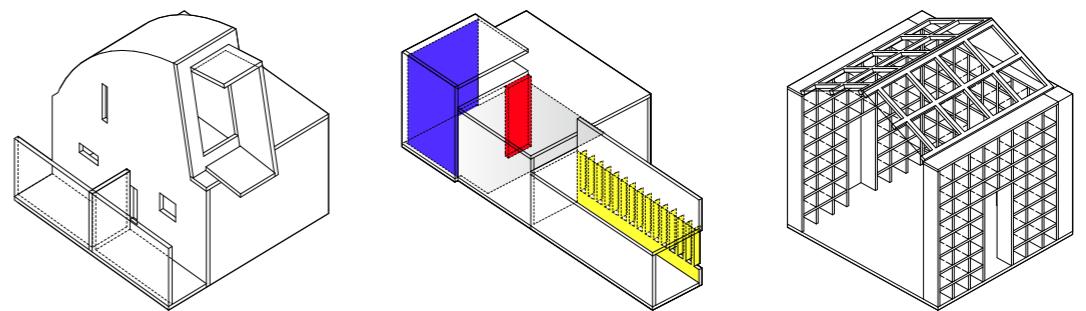


Color Goggles, Chapel of St.Ignatius, Steven Holl

Precedent Models

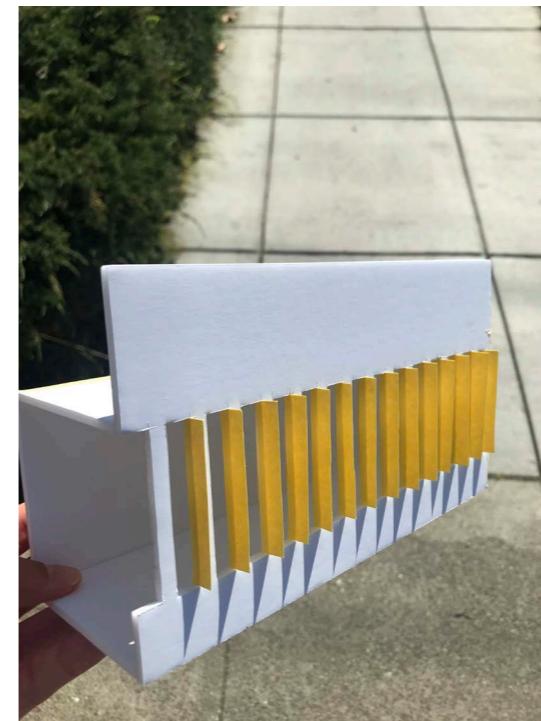
[Casa Gilardi]

I also studied Casa Gilardi by Luis Barragan. I modeled the saturated yellow hallway and pool room using construction paper and foil. By adding the prospect of color beyond, this perspective becomes more dynamic through contrast and saturation.

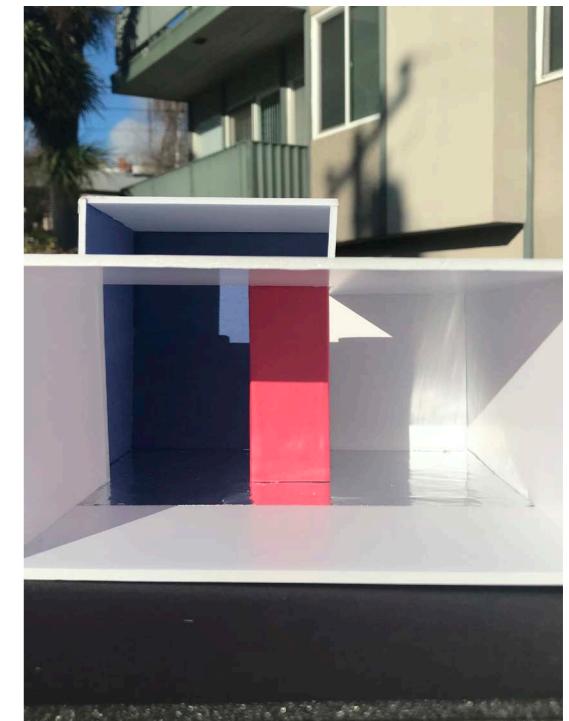


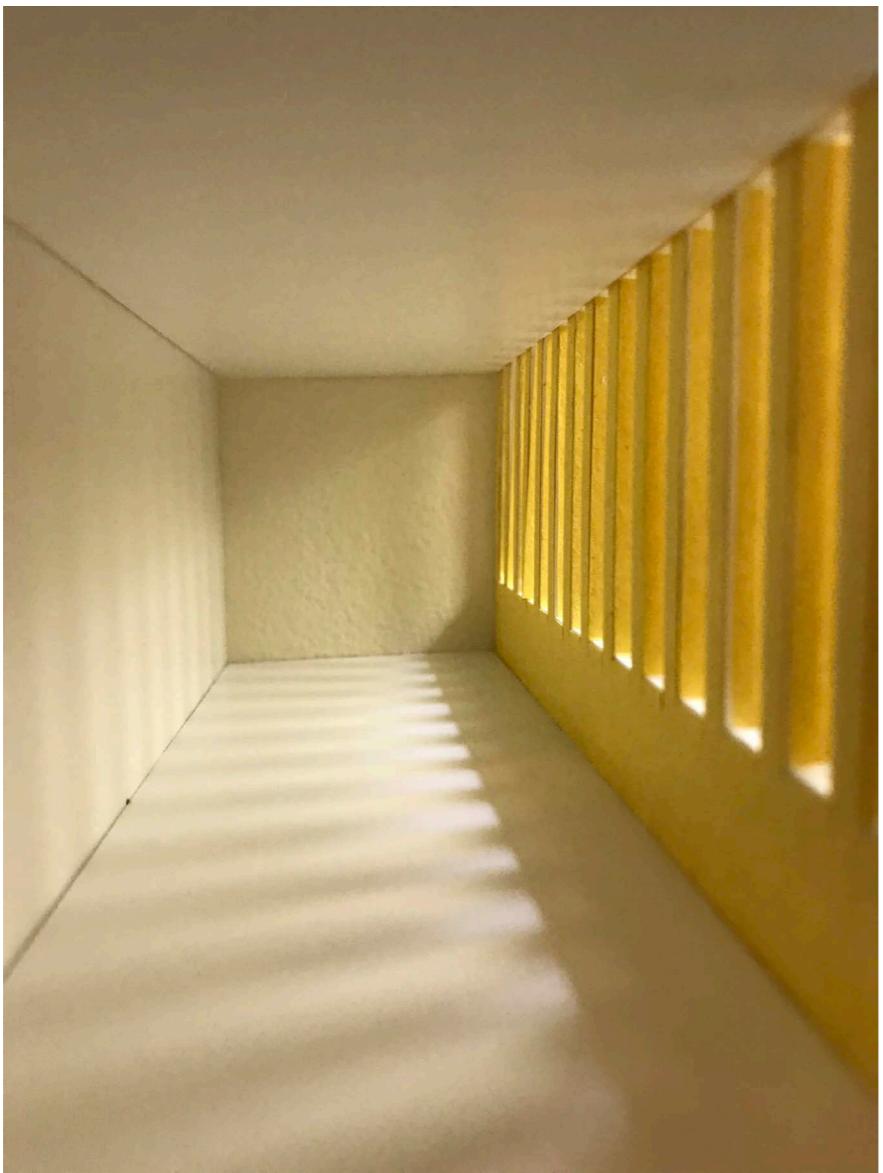


Casa Gilardi, Luis Barragan

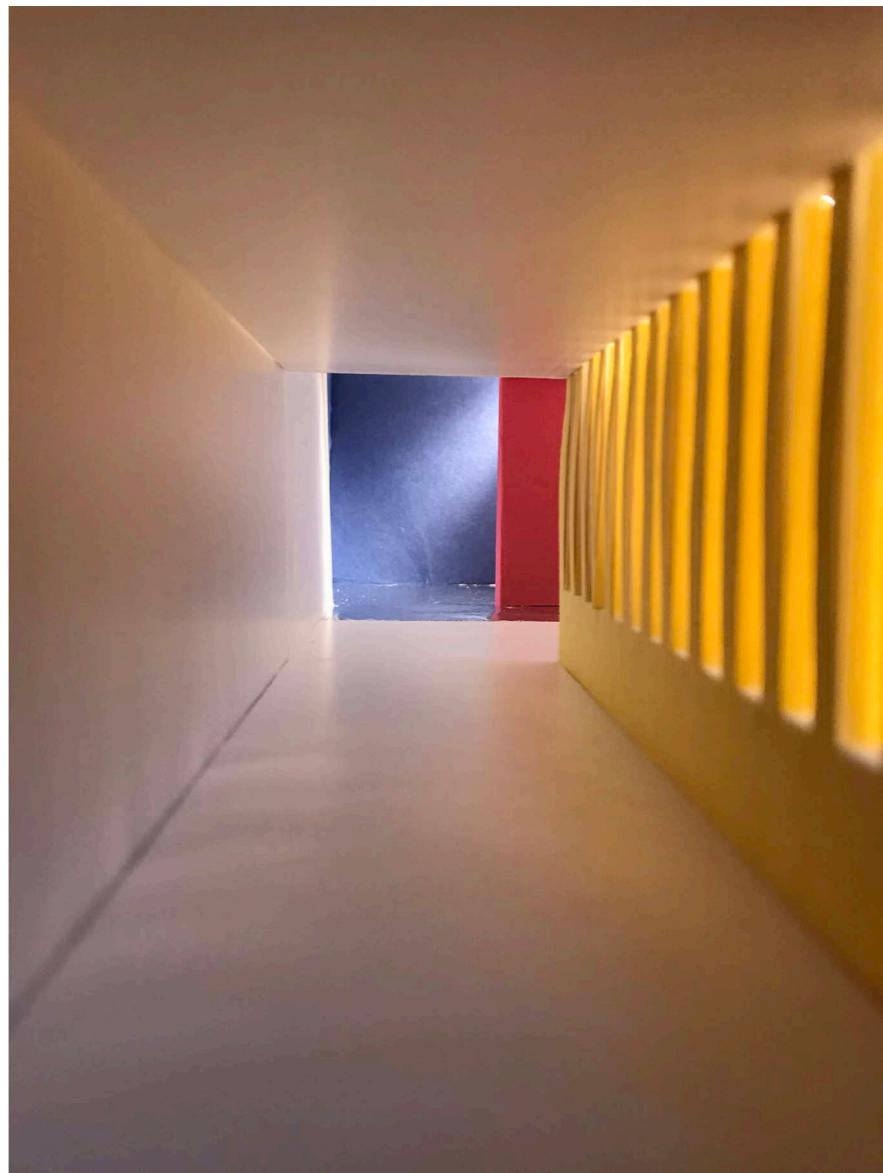


Minature, Casa Gilardi, Luis Barragan





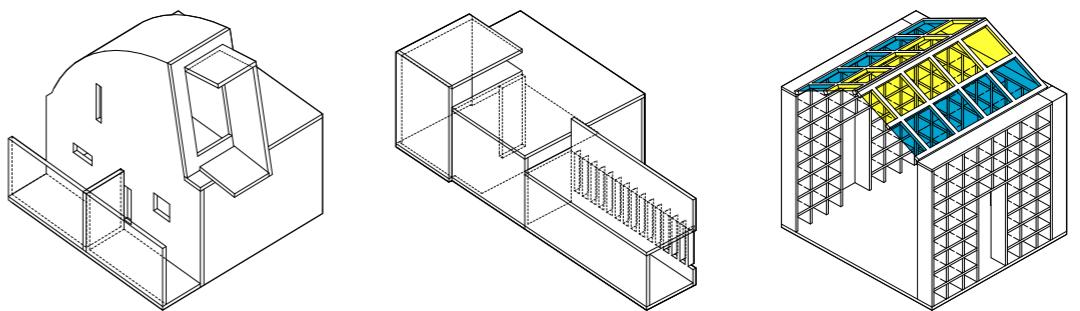
Minature, Casa Gilardi, Luis Barragan

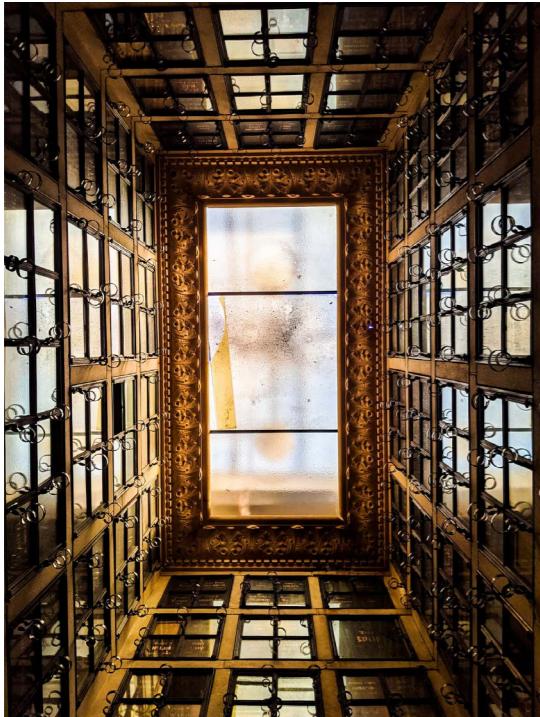


Precedent Models

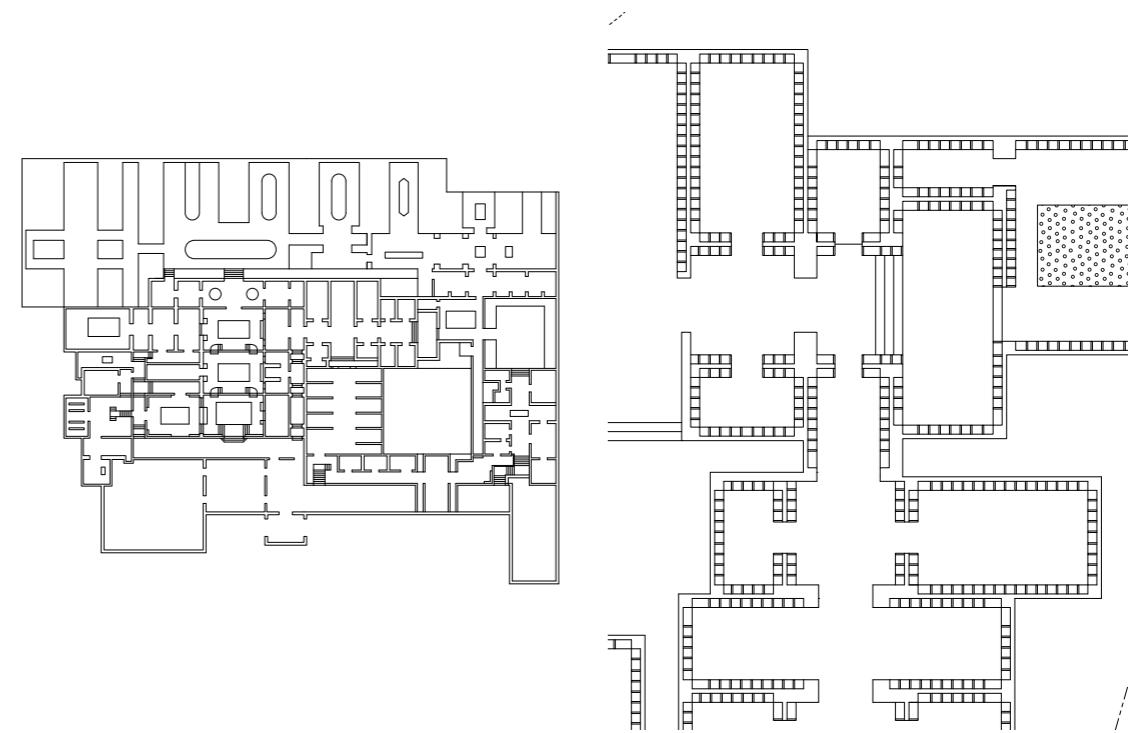
[Chapel of the Chimes]

Chapel of the Chimes by Julia Morgan is a labyrinth of columbarium niches, where the depth of the urn determines the wall thickness. Primarily top lit, the rich materiality of the niches and urns reflect light into the space. I used foil and an open grid to study the comparison between glowing specular versus naturally backlit niches.





Chapel of the Chimes, Julia Morgan



Plan Detail Study



Minature, Chapel of the Chimes, Julia Morgan

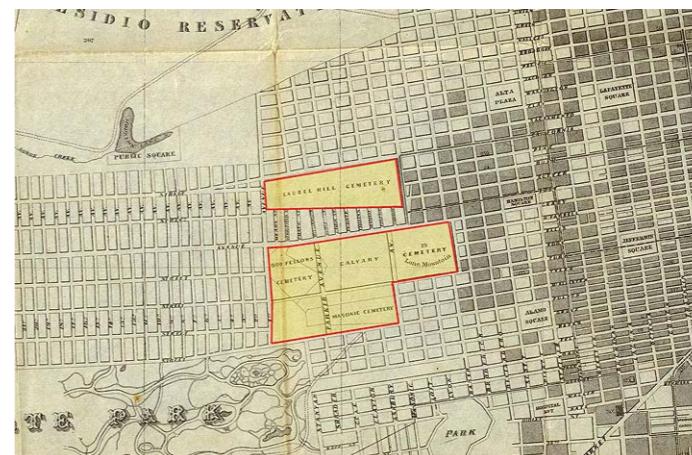


Site

[Urban Site Selection]

By choosing an urban site, I challenge the convention of pushing the dead to city outskirts. In the early 1900s, San Francisco closed its four major cemeteries and exhumed its dead to Colma, a farmland outside the city.

This project reinserts death and mourning back into the city through a columbarium and cemetery complex in the San Francisco Mission District. This site is half a mile from 16th st. bart, and one block away from a crematory, allowing for easy visitation access for mourners.



above | 1870 Map of San Francisco's Big Four Cemeteries

below | Colma California, necropolis of San Francisco Bay Area

16th St. Mission BART Station

City Cremation, SF Bay Area Crematory

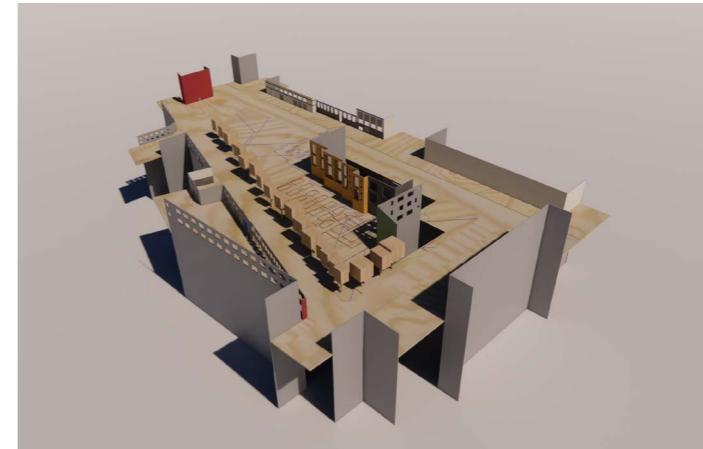


Site Plan, San Francisco Mission District

Site

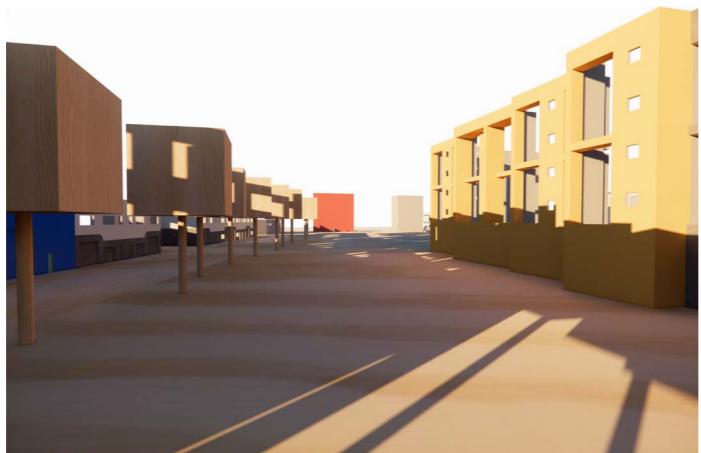
[Site Model]

The site model studies the effect of the neighboring facades on the site, with the facades extended to create model legs. Cuts of the existing building footprints create light wells underneath the site model. The context facades changed color over the course of the day and year. To note shadow, I used blue, green, and red string to mark shadow lines for the winter solstice, equinoxes, and summer solstice.

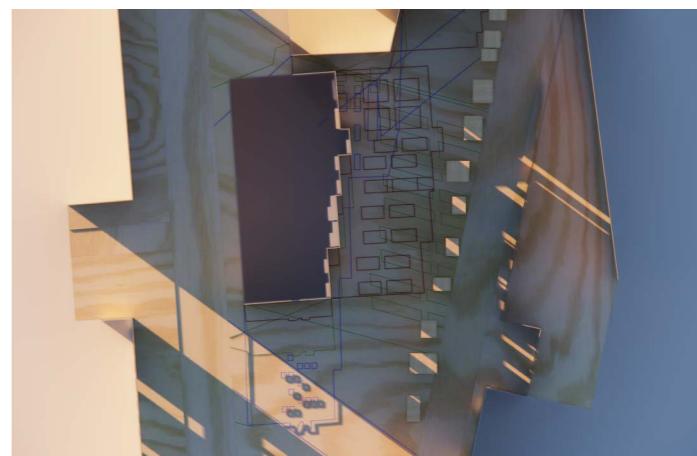
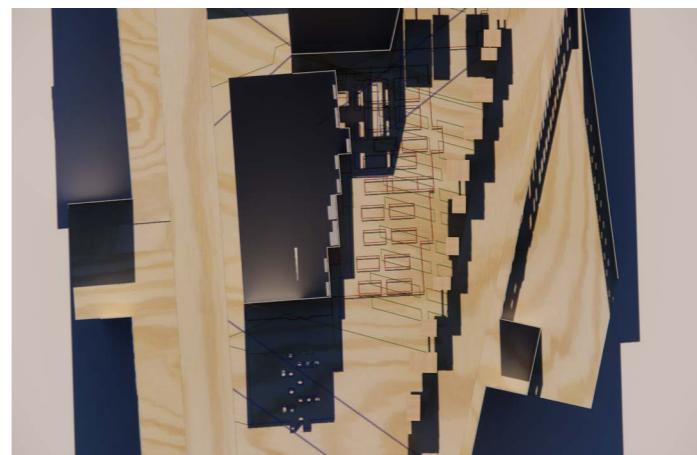
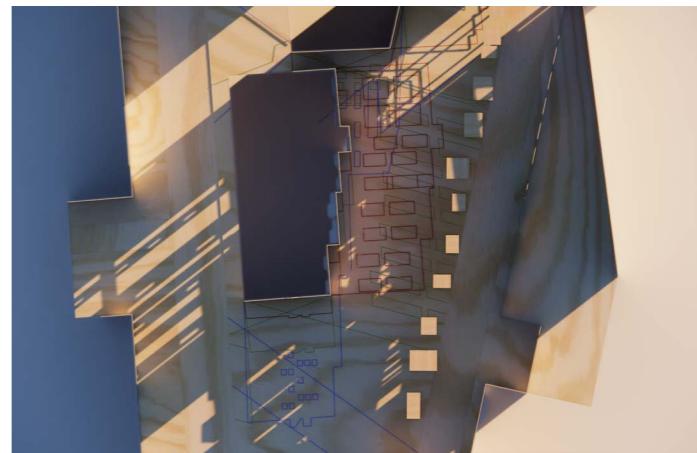


above | Site Model

below | Site Model, Underneath



Site Model Facades | 8am, 12pm, 4pm



Site Model, Notating Shadow | 8am, 12pm, 4pm

Material

[Columbarium]

For the project's materiality, I was inspired by this byzantine columbarium with niches cut into massive limestone for housing doves. A columbarium is defined as the respectful and public storage of funerary urns and also as nesting housing boxes of pigeons.

The material test model looks onto a color wall exposed to sunlight. I experimented with columbarium walls made of a wood assembled grid, clay molded amorphous shapes, and concrete poured openings.



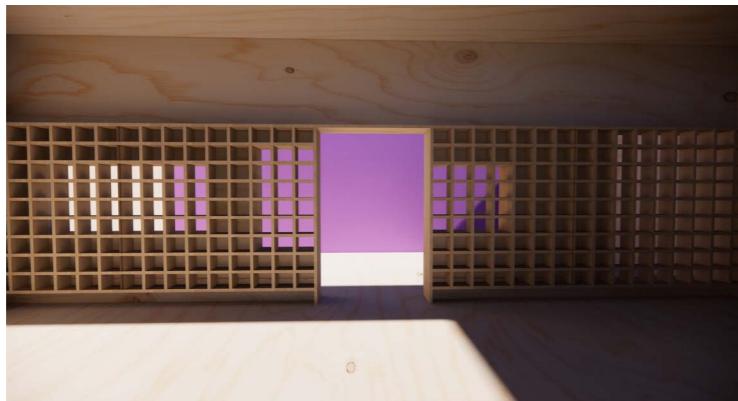
Byzantine Columbarium, 3rd century BCE, Israel



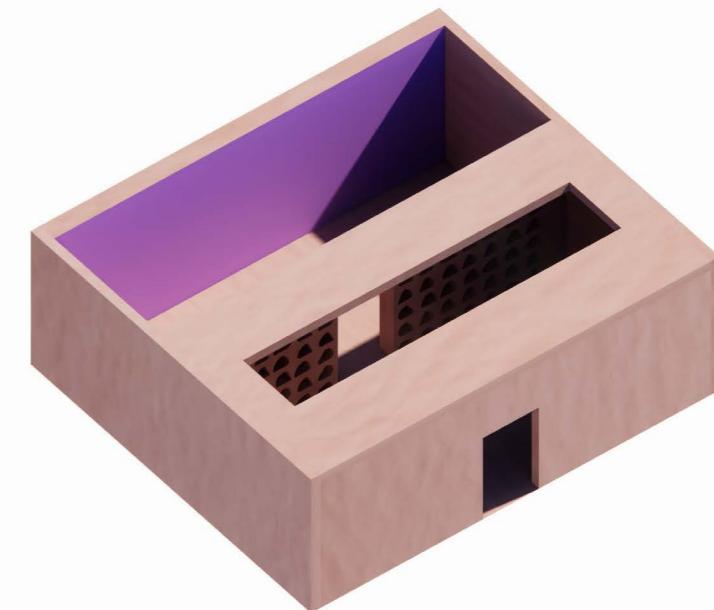
Columbarium Interior Elevation Sketches

Columbarium

1. A structure for the respectful and public storage of funerary urns, holding cremated remains of the deceased
2. Nesting housing boxes of pigeons, Latin "columba" means dove



Columbarium Wall Material Studies | Wood, Clay, Concrete



Material Test Model

Material

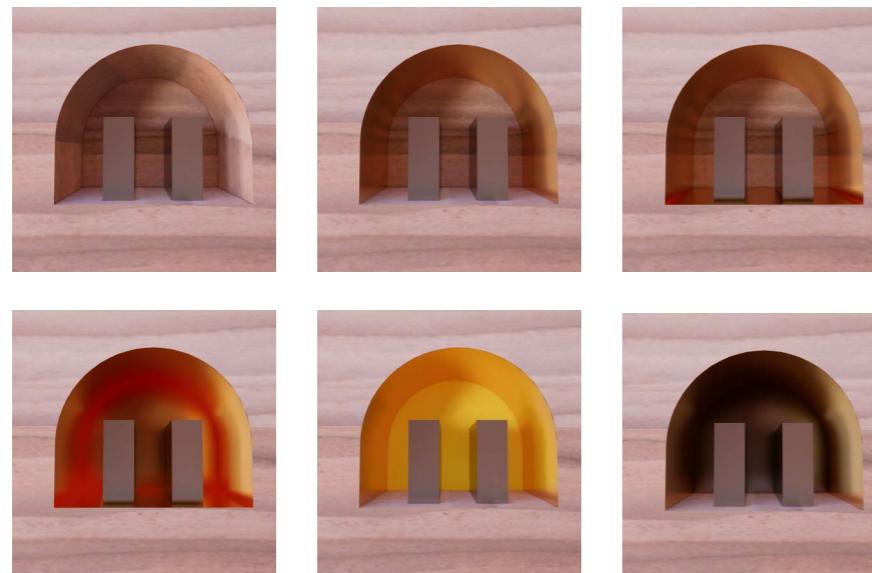
[Niche]

Next, I tested out different materials for the niche openings with: reflective metals, color, and views of the daylit colored wall beyond.

The simple test model simulates the arched niche openings, naturally backlit by orange, purple, and pink light wells beyond. Gold leaf reflects the saturated color onto the specular finish.



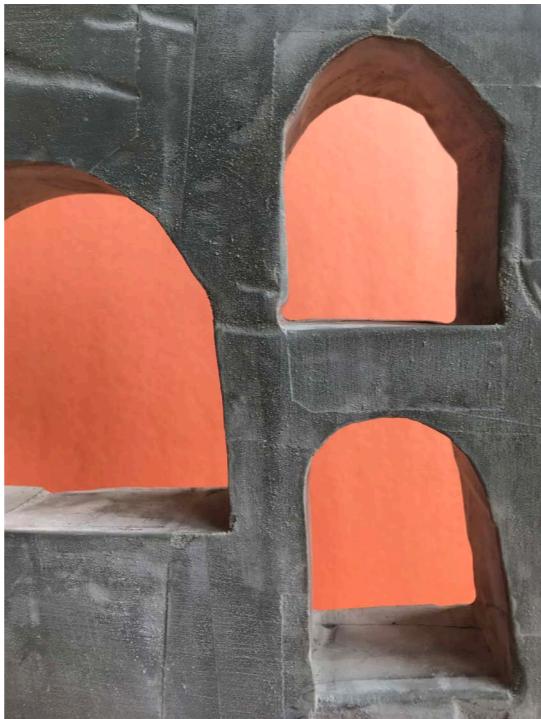
Niche Model, Pink Light Well Gold Leaf



Niche Material Tests



Niche Material Tests, Natural Backlighting

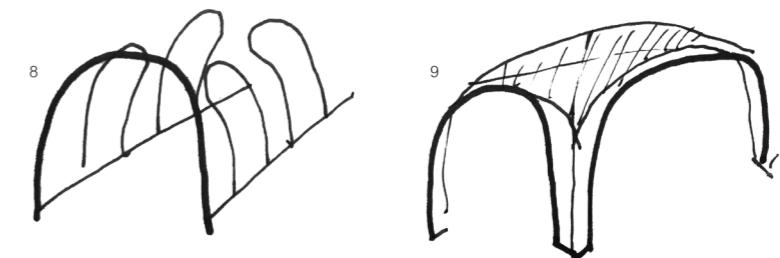
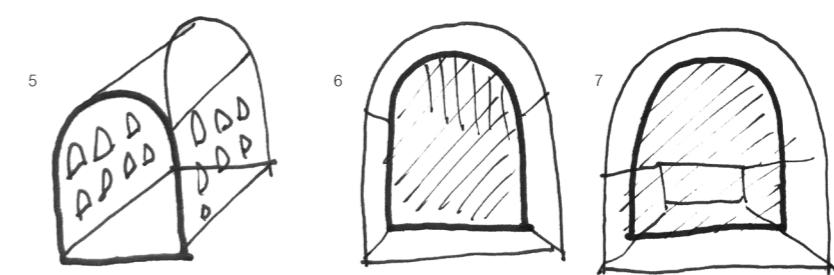
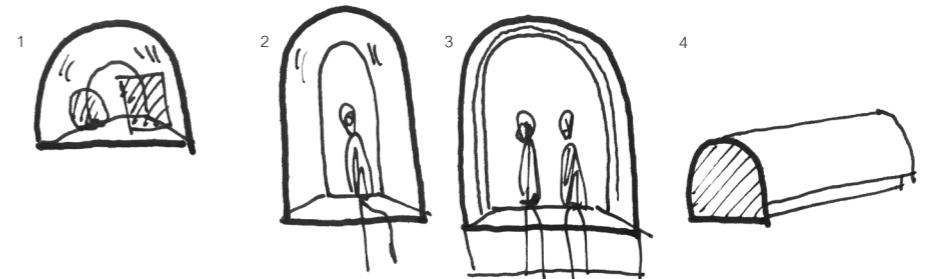


Niche Model, Light Well | White, Orange, Purple, Pink

Building Design

[Arch Form]

The final building design takes on the motif of the arch form. This thickened shape modulates light along its curved surface. At a human scale, the arched shape is the urn niche, window seat, and extruded shape for the sarcophagus. At the room scale, the arch becomes barrel vault rooms and hallways.



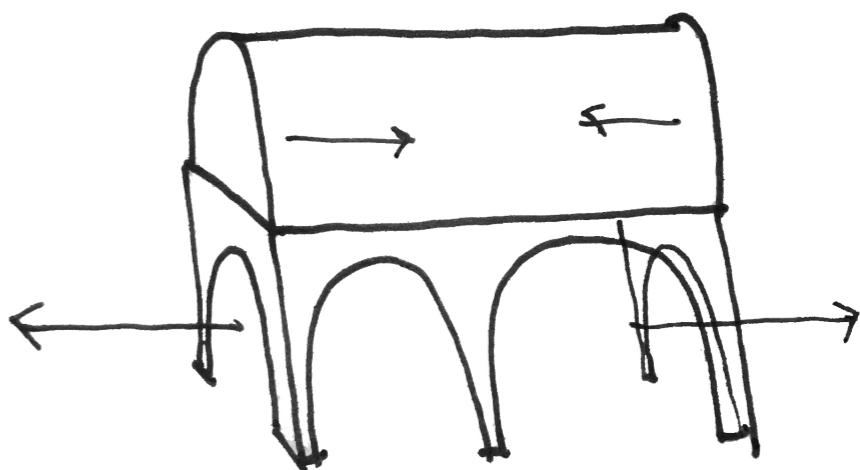
- 1 Urn Niche
- 2 Window Niche
- 3 Window Seat
- 4 Sarcophagus
- 5 Columbarium Room

- 6 Wall Washing End Wall
- 7 Colored Glass End Wall
- 8 Columbarium Hallway
- 9 Cemetery Groin Vault Ceiling

Building Design

[Inward vs. Outward]

The two programs are distinct with an upper level columbarium and a street level cemetery.

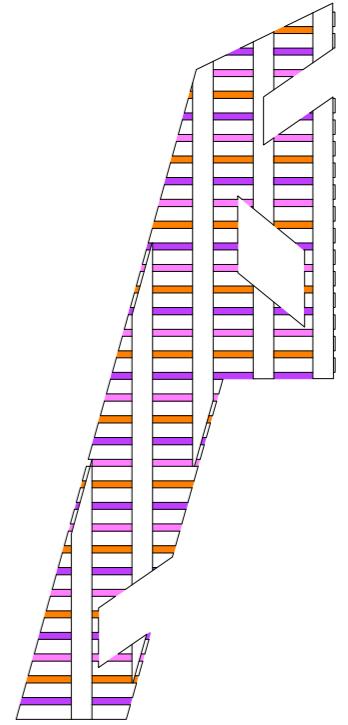
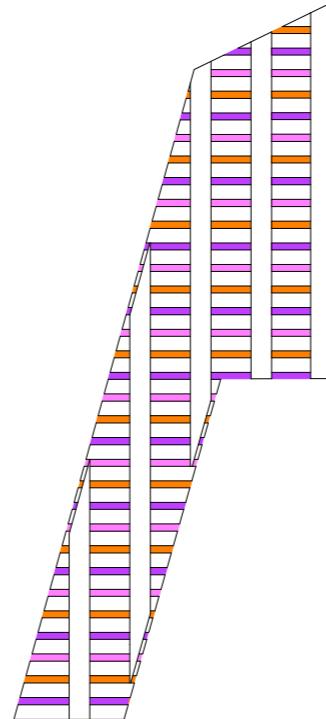


Inward Outward Diagram

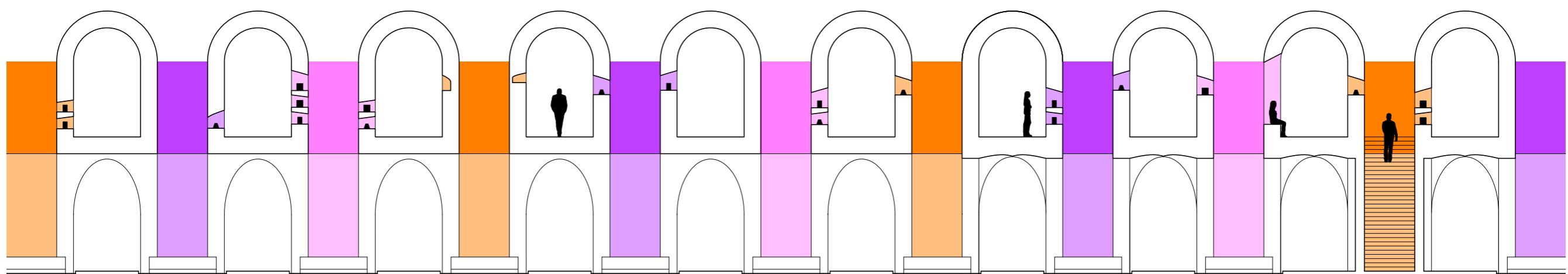
Building Design

[Color Application]

Lightwells between the barrel vaults are painted in pink, orange and purple - backlighting the columbarium niches.



Color Lightwell and Courtyard Plan Diagram



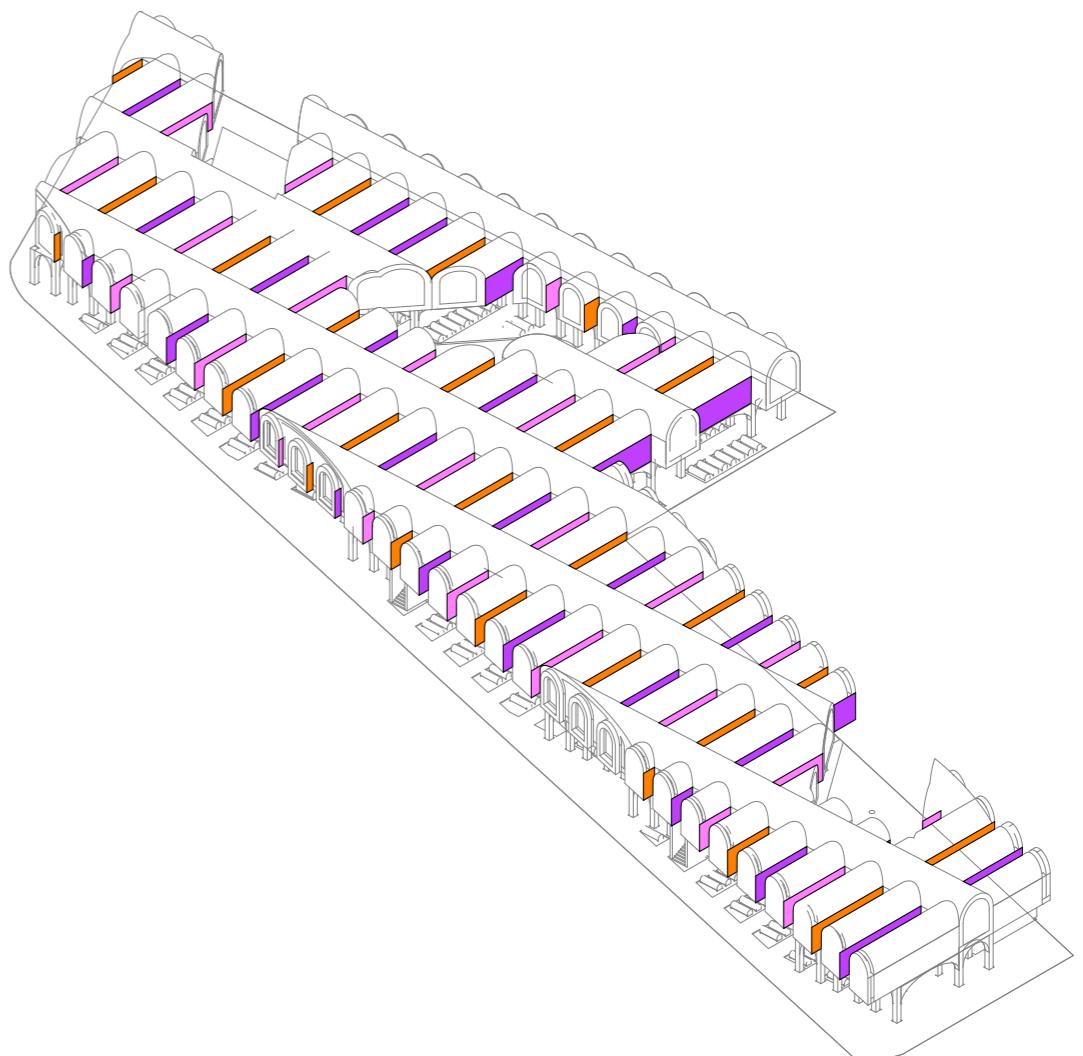
Color Lightwell Section Diagram

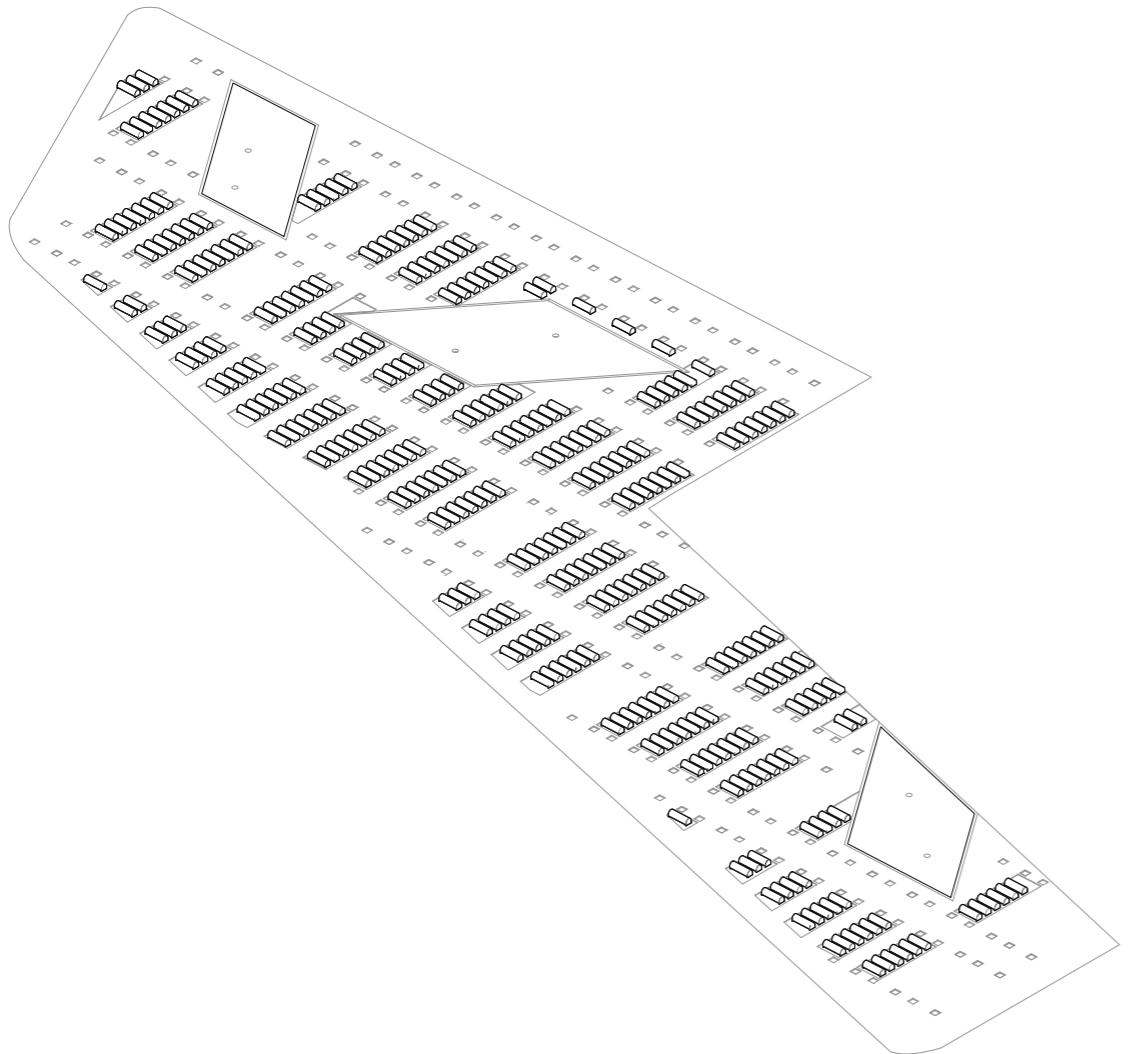
Building Design

[Overall Axon Diagram]

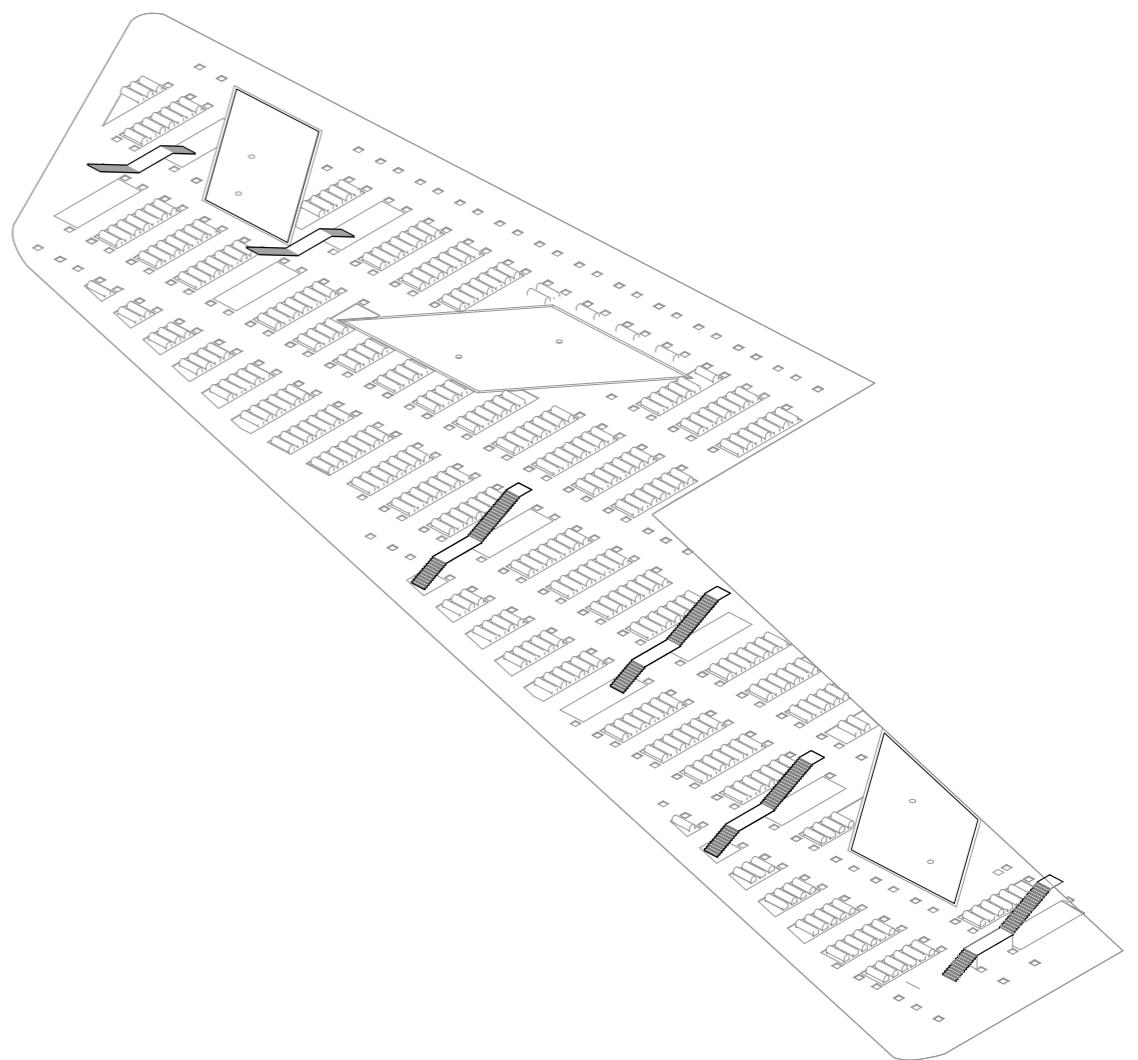
The street level cemetery is open to the public, populated with sarcophagi, stair entrances to the columbarium above, a hypostyle hall made up of arched columns and vaulted ceilings.

The second floor columbarium is a dense network of barrel vaults with alternating color light wells. The typical end wall condition is painted yellow with a wall washing skylight. When courtyards cut into the grid or the barrel vaults collide, color glass end walls add transparency and additional colored light. The end wall condition at Harrison Street is a series of window seats ringed with a small strip of natural light.

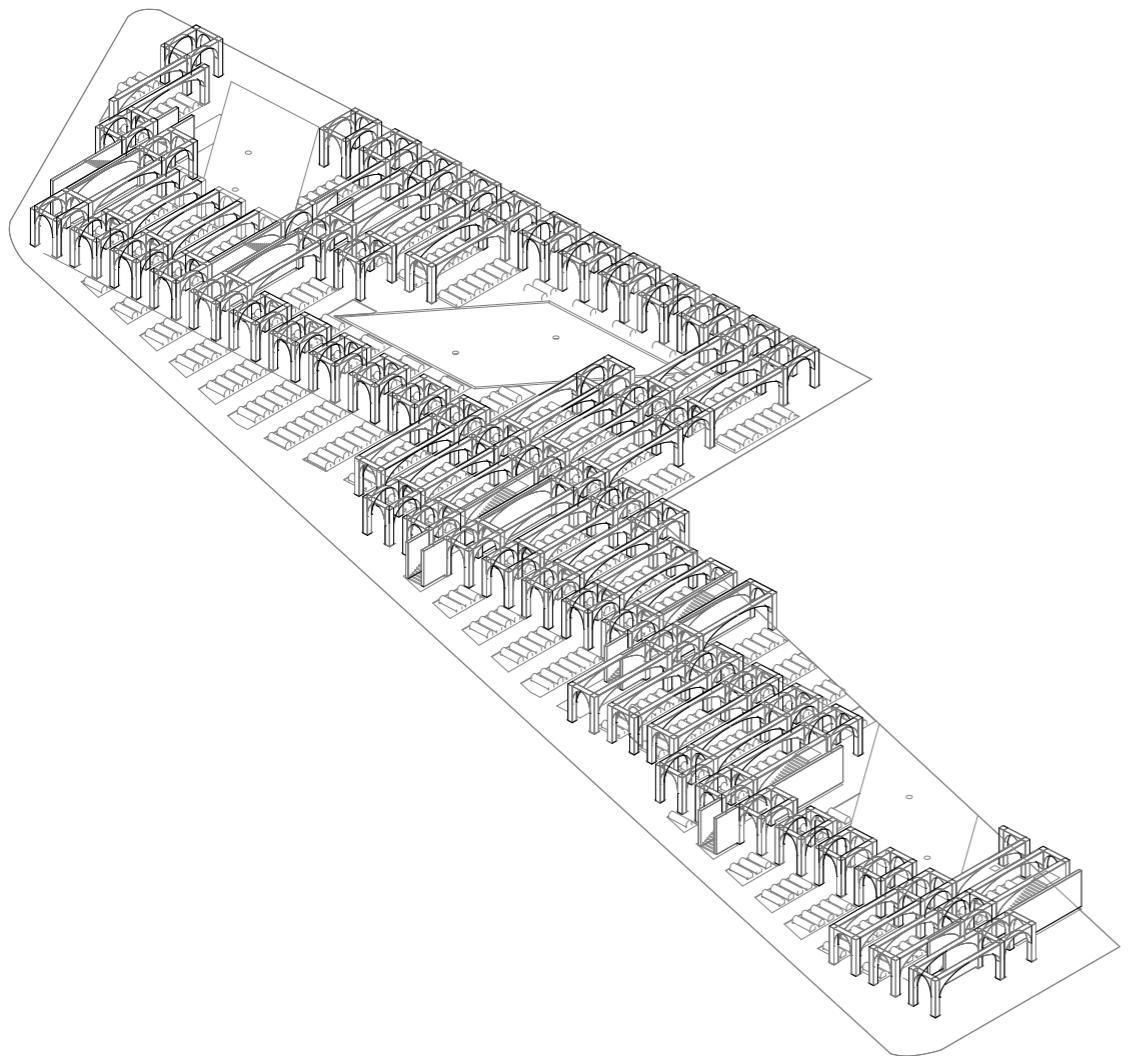




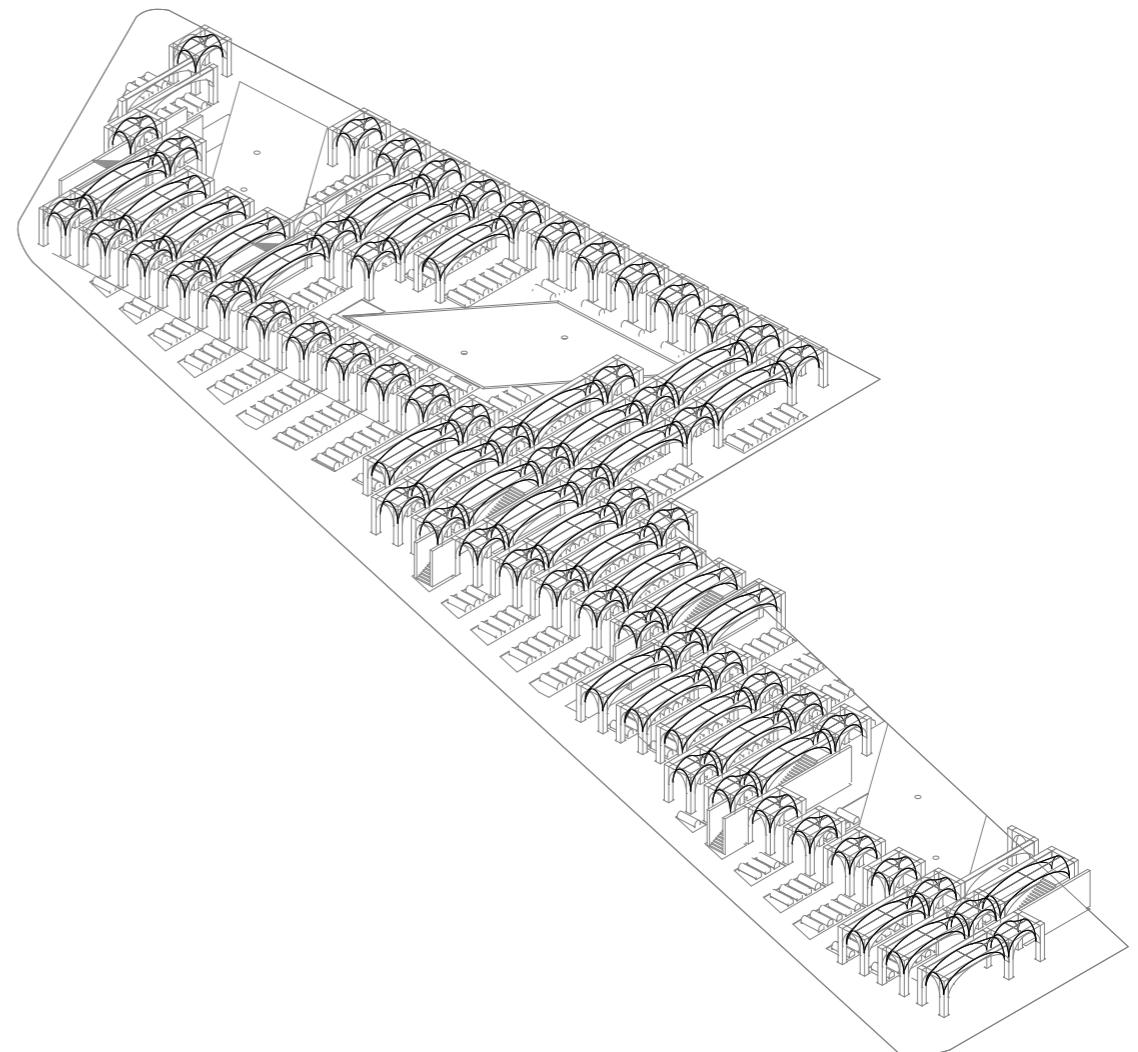
Overall Axon - Sacrophagi



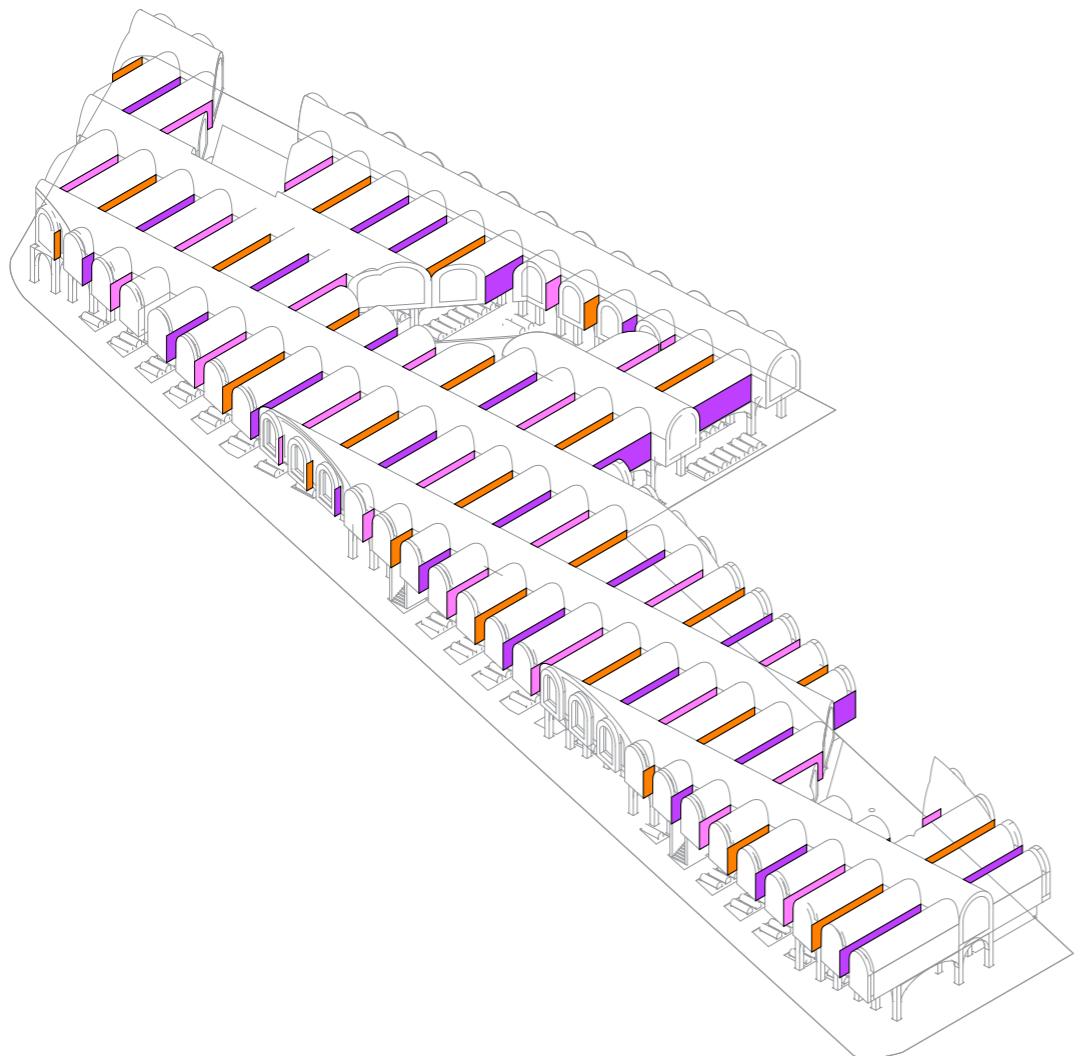
Overall Axon - Circulation



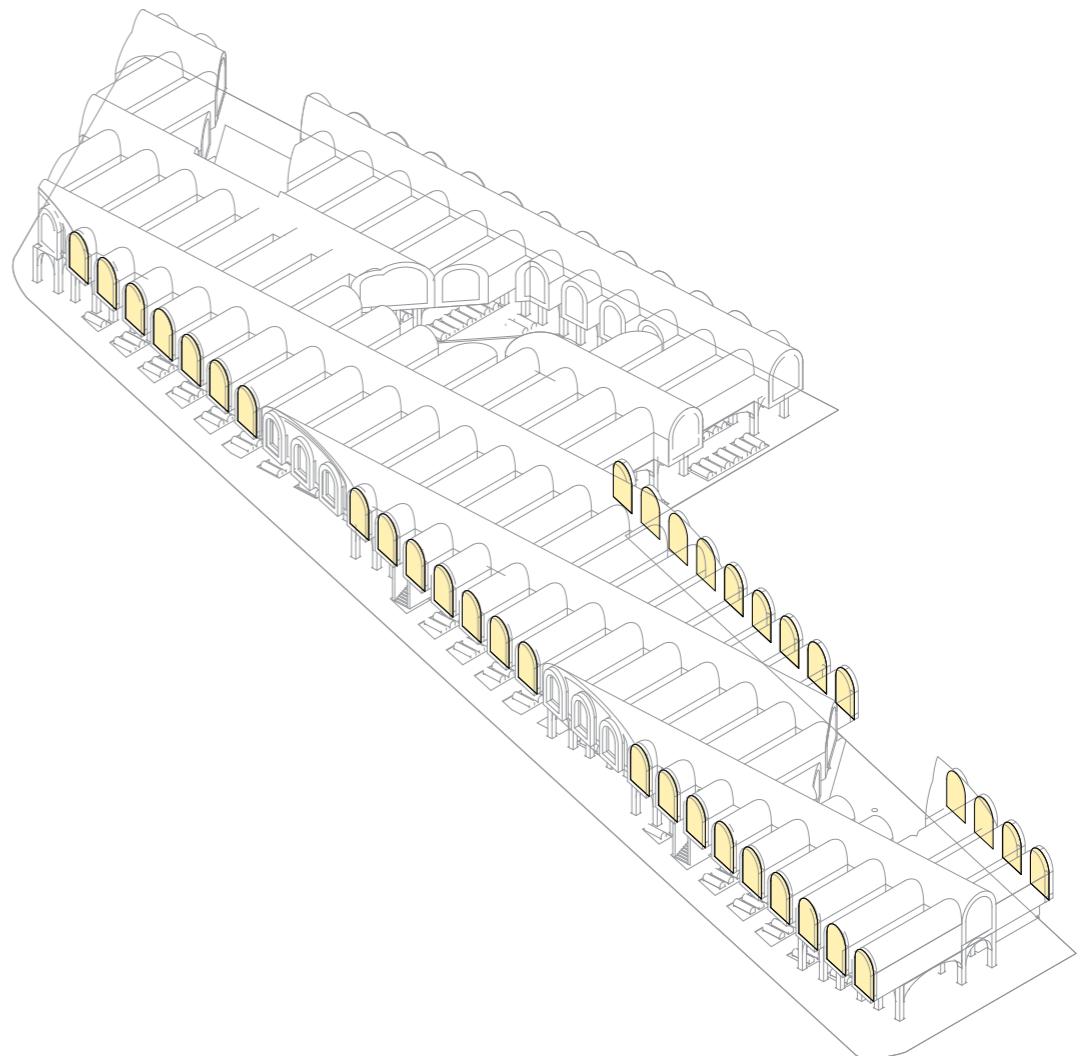
Overall Axon - Hypostyle Columns and Arches



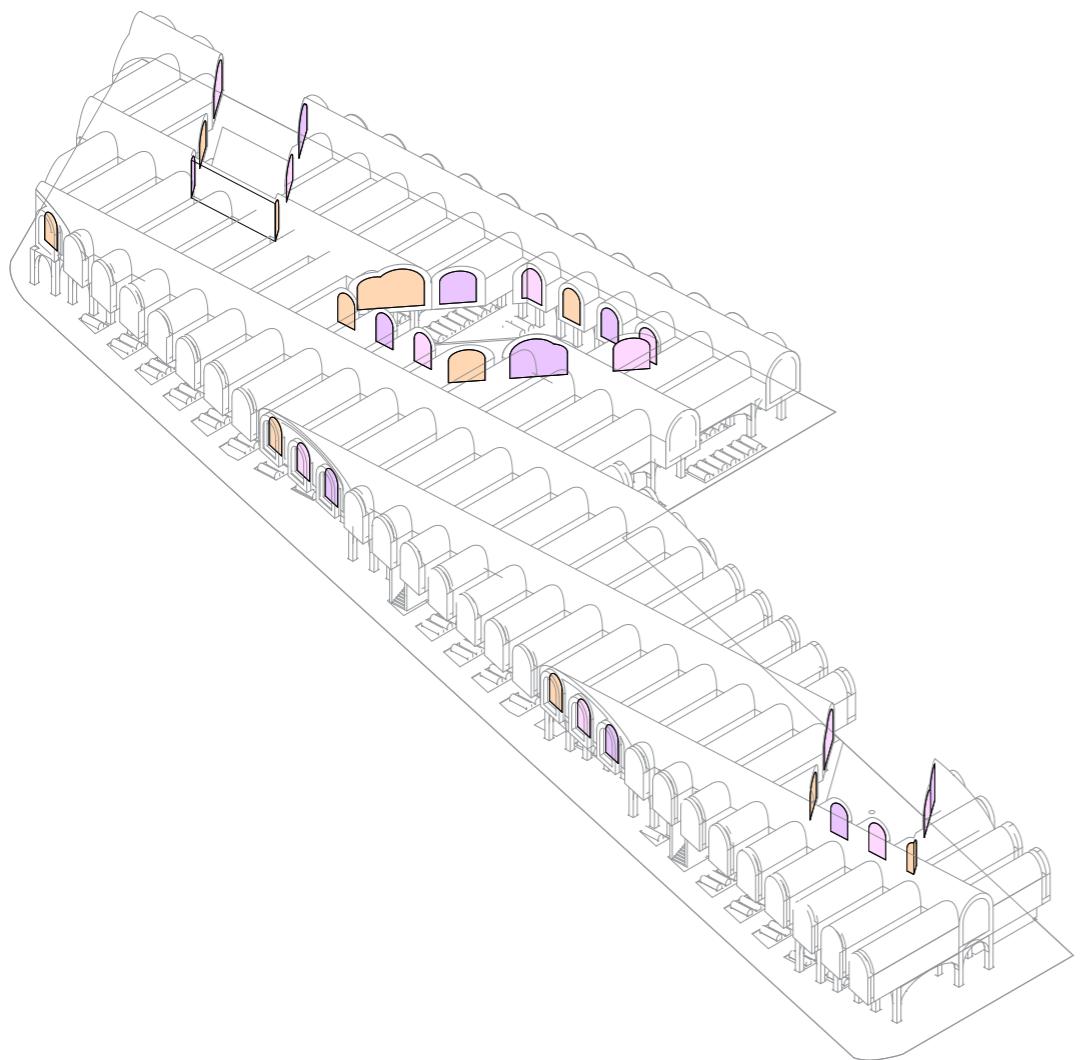
Overall Axon - Vaulted Ceiling



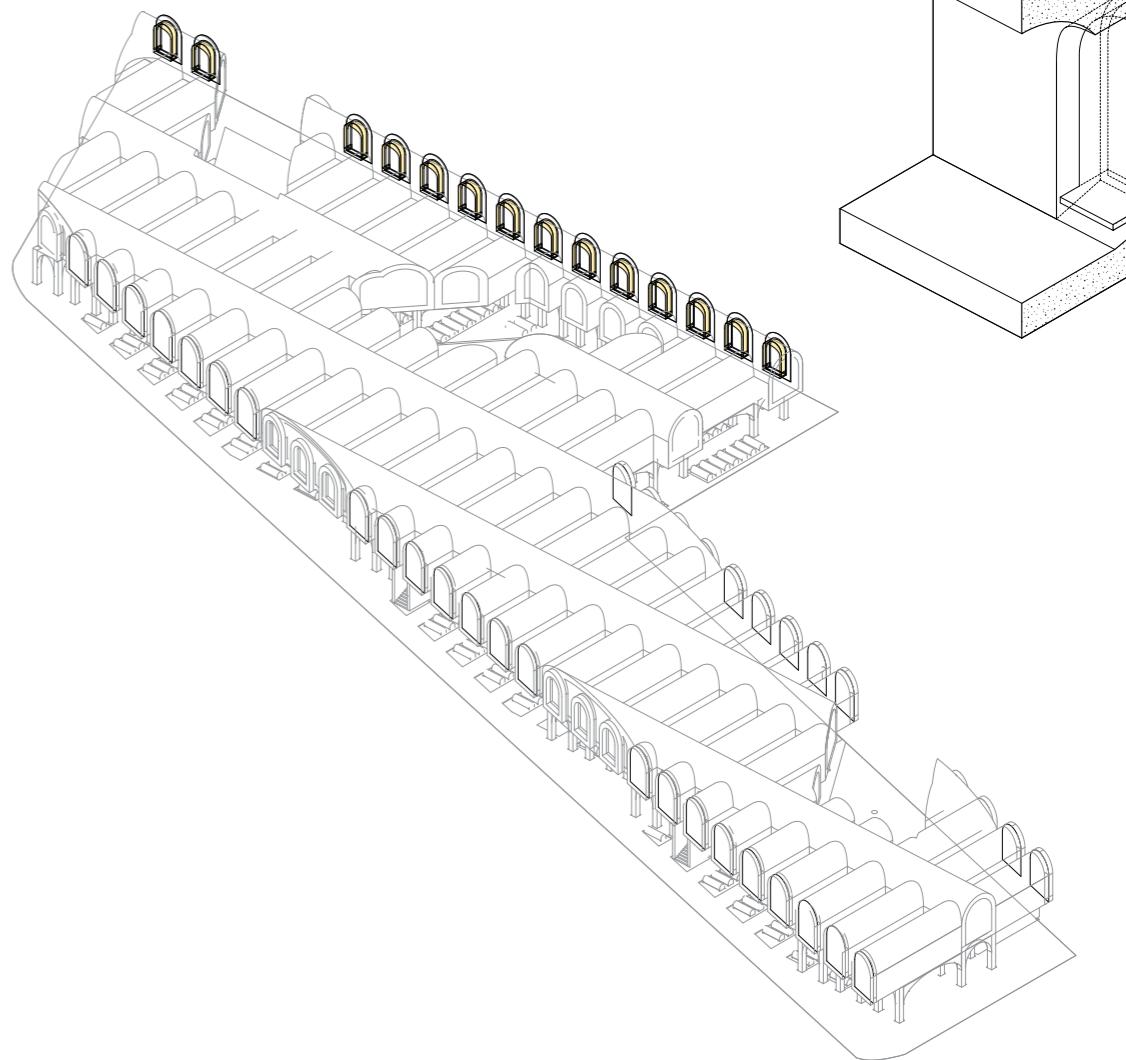
Overall Axon - Color Light Wells



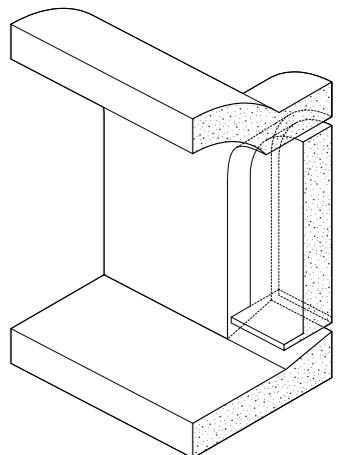
Overall Axon - Yellow End Walls, Wall Washing



Overall Axon - Colored Glass Endwalls



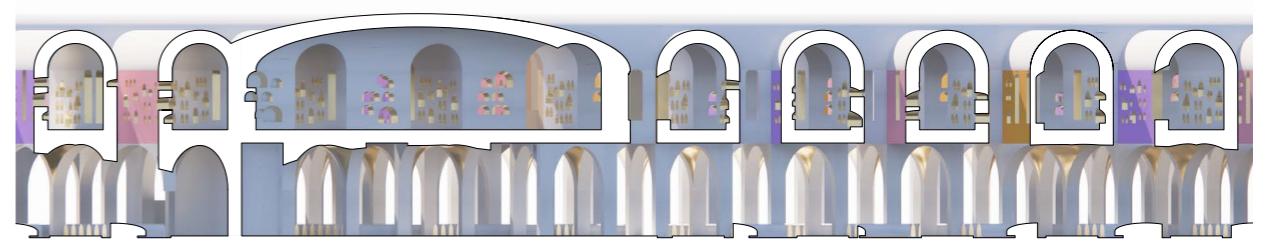
Overall Axon - Window Seats



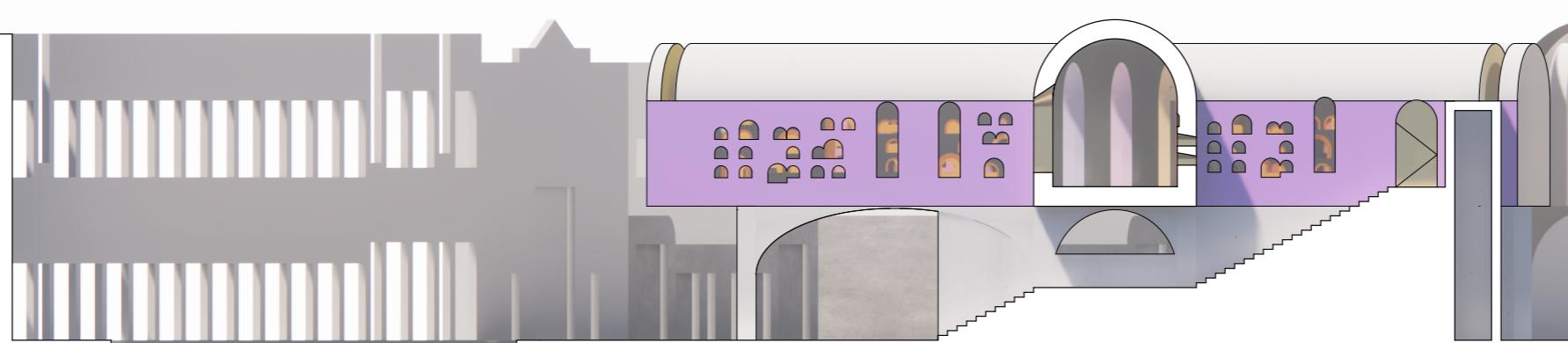
Building Design

[Section Sequence]

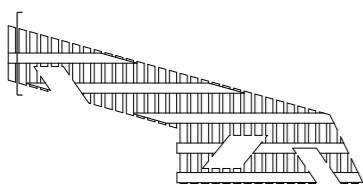
Visitors can walk up the street level stairs to enter the columbarium. Primarily a darkened space, the niches are the main source of illumination and glow from the light and color beyond. The upper floor columbarium is primarily inward looking, while the street level cemetery becomes part of the urban fabric. The colored glass end walls occasionally open out to a small balcony, providing outdoor relief and views of the courtyards. Window seats and window niches in the wall thickness provide spaces for individual contemplation. At an urban scale, this columbarium and cemetery inhabit the city block, providing a much needed space for mourning within the city.

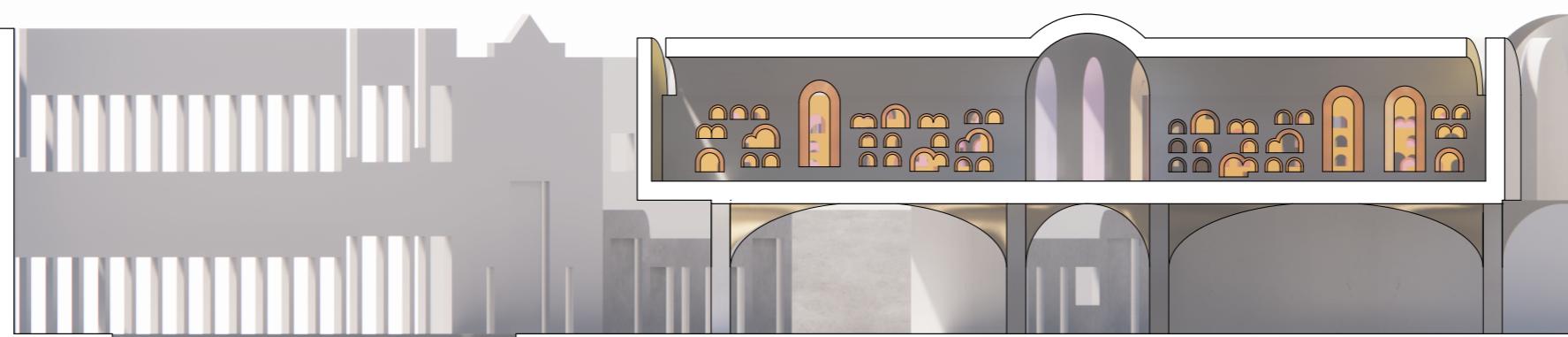


Longitudinal Section Detail

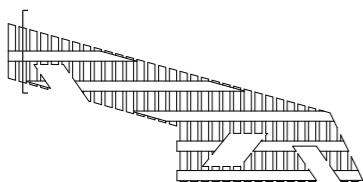


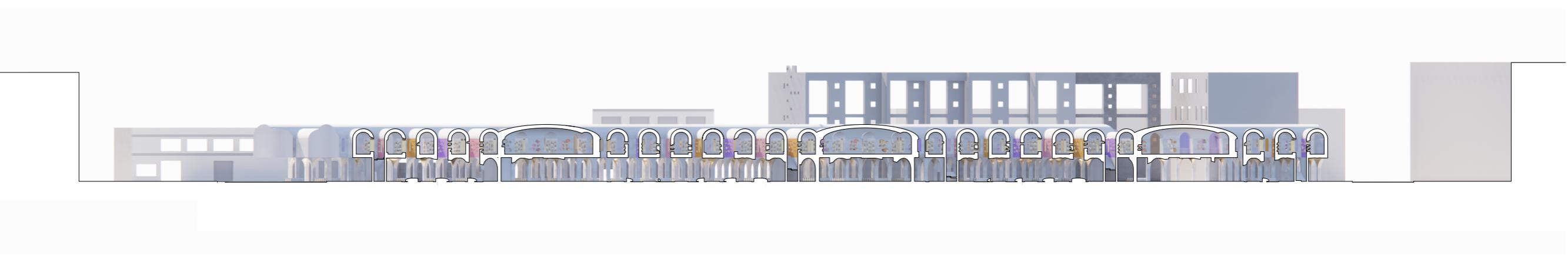
Transverse Section looking North



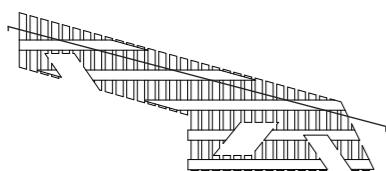


Transverse Section looking North





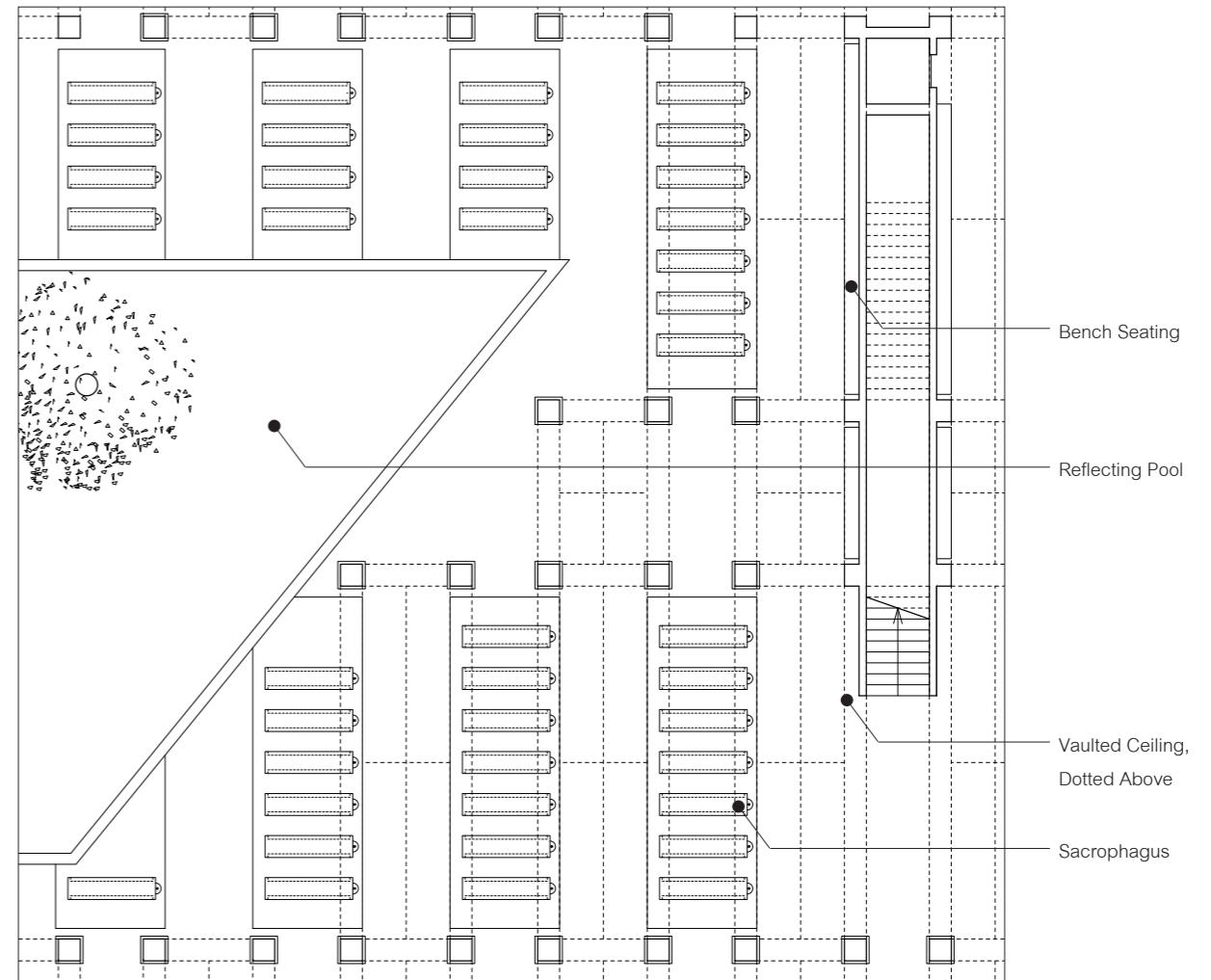
Longitudinal Section looking East

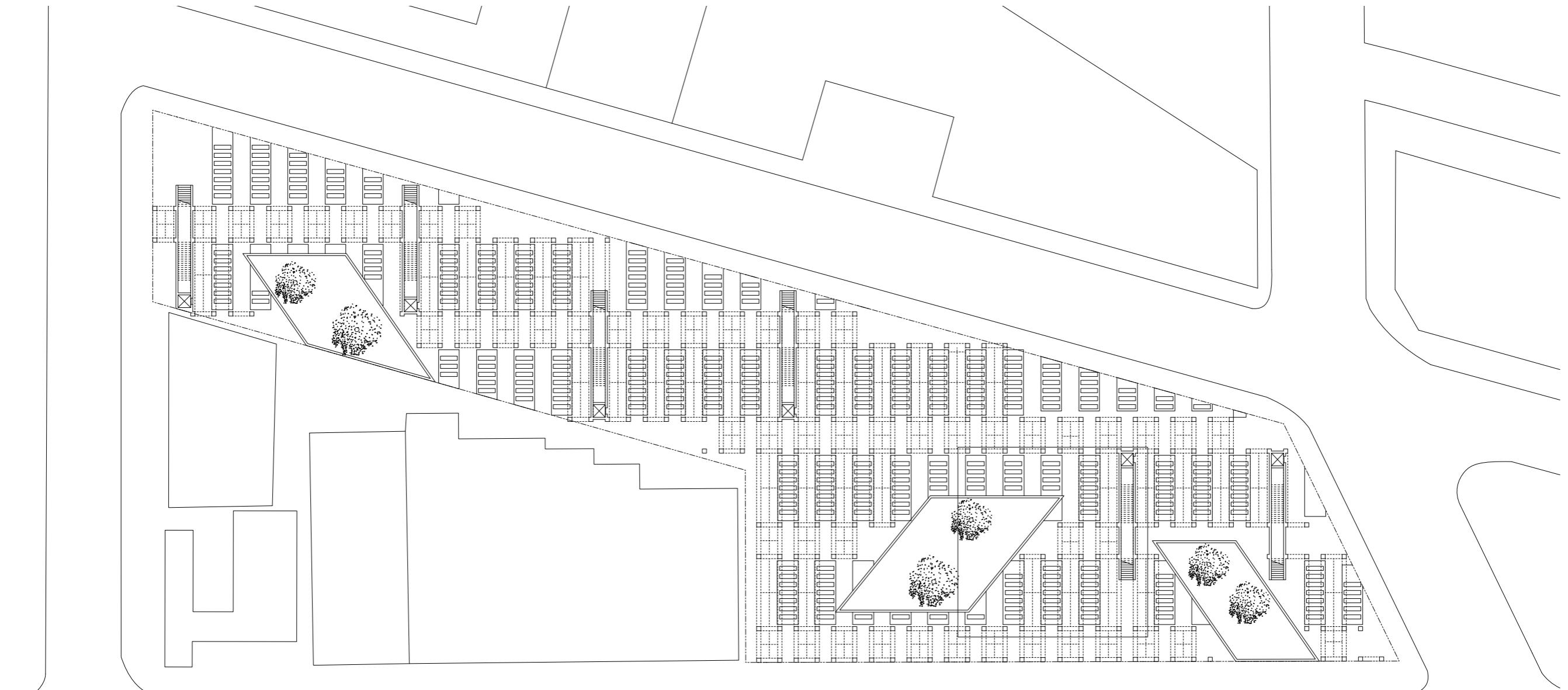


Urban Cemetery

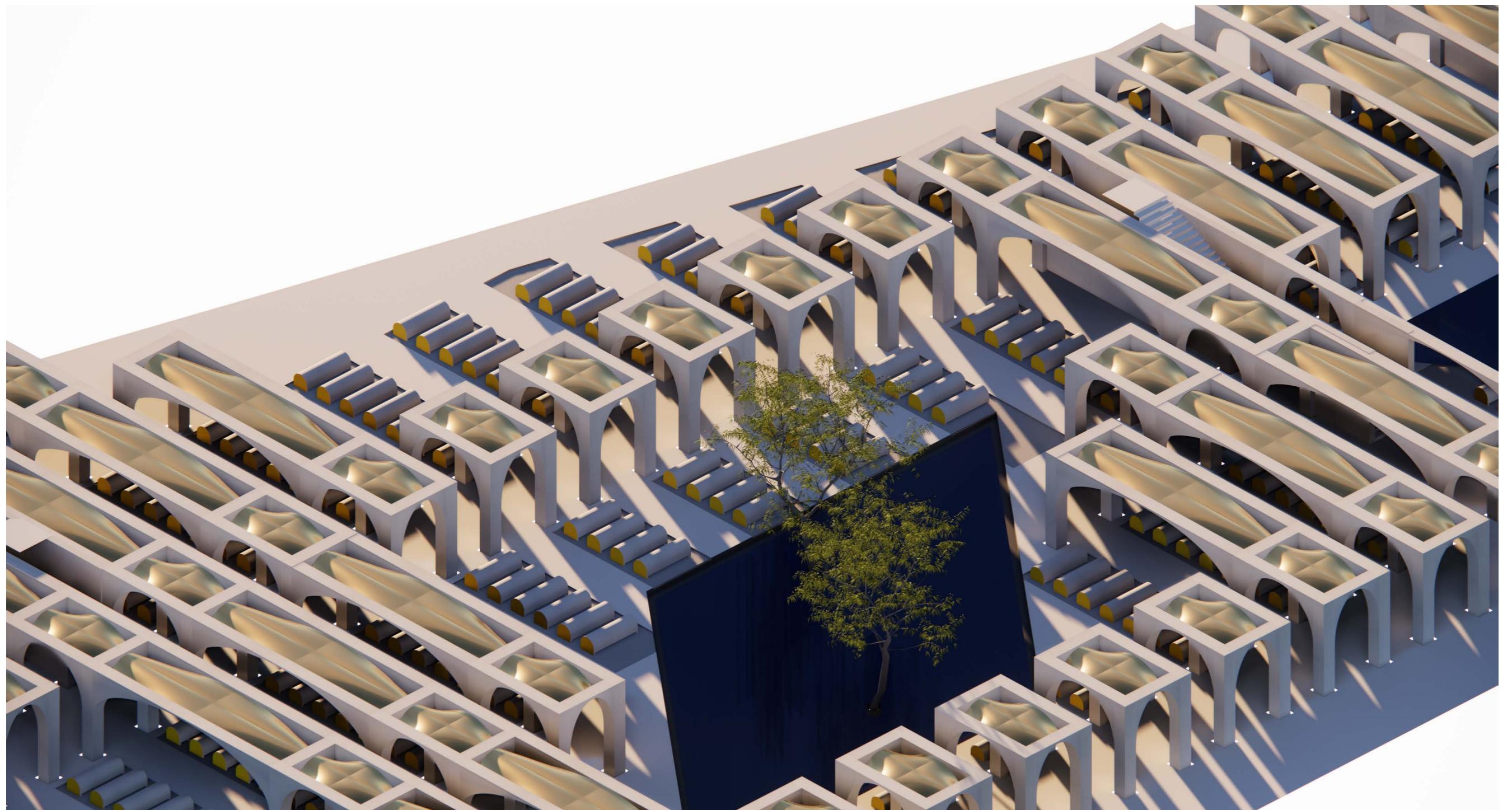
[Overall Design]

The cemetery is made up of a grid network of lowered sacrophagi plots and sidewalk level walking paths. The sacrophagi plots are placed underneath the color light wells, giving deceased the most sacred placement under natural light. Courtyard reflecting pools, interspersed with trees, interrupt the grid. The vaulted ceilings are made of the metallic finish, bringing an internal glow within the cemetery walkways.





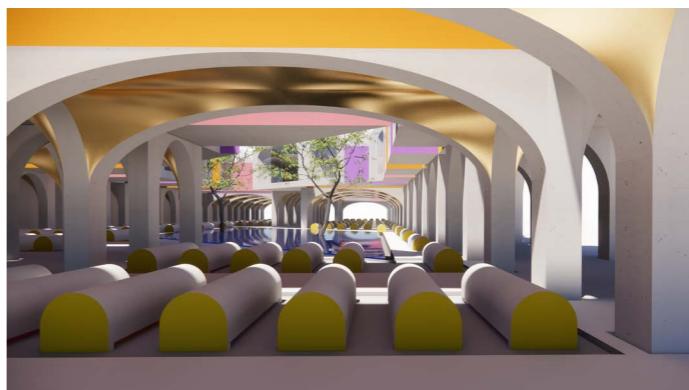
Ground Floor Plan - Cemetery



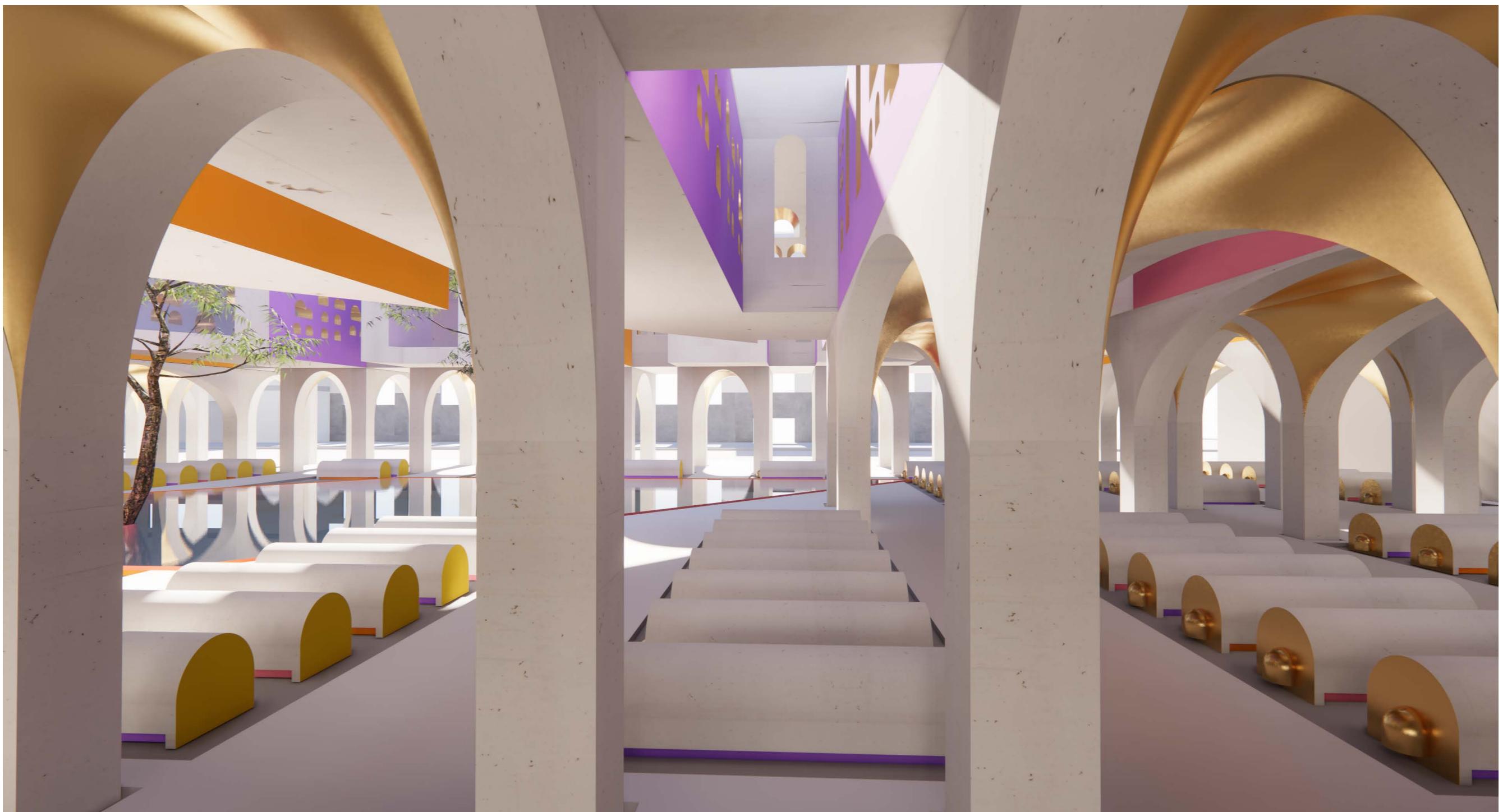
Urban Cemetery

[Color and Time]

The field of repetitious sacrophagi and arched columns becomes variegated under the colored light wells and changing sunlight over time. Upward views of applied saturated color and distinct placement of metallic finish bring life and color to this landscape of the dead. During the morning, San Francisco commuters can cut across this city block walking amongst the colored light wells, sacrophagi, and reflecting pools. Midafternoon, the pools reflect pink light upwards onto the concrete. Some sacrophagi faces have a specular brilliance from direct sunlight. Ranges of colors are present everywhere in this landscape of the dead.



Cemetery Rendering | 8am, 1pm, 8pm

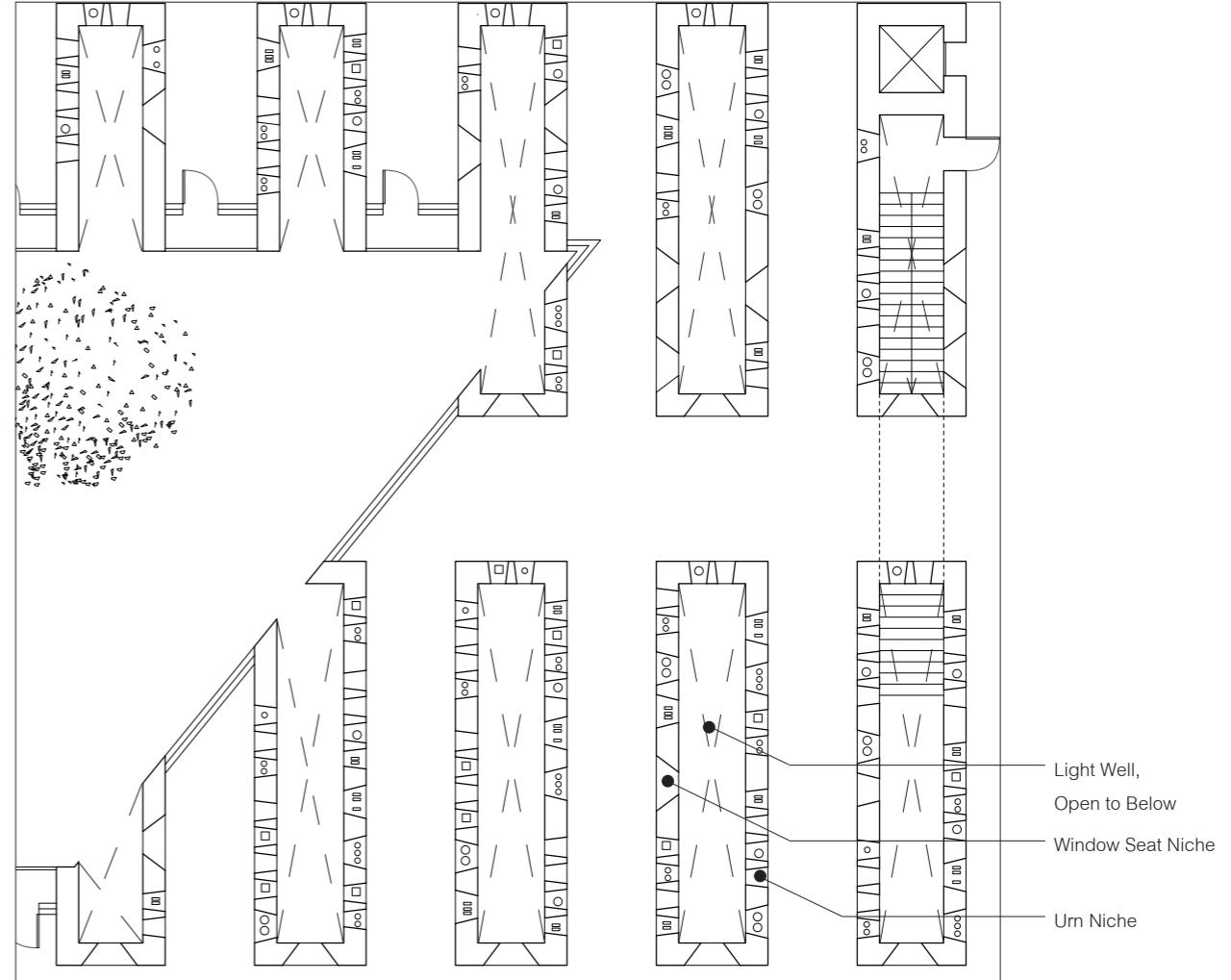




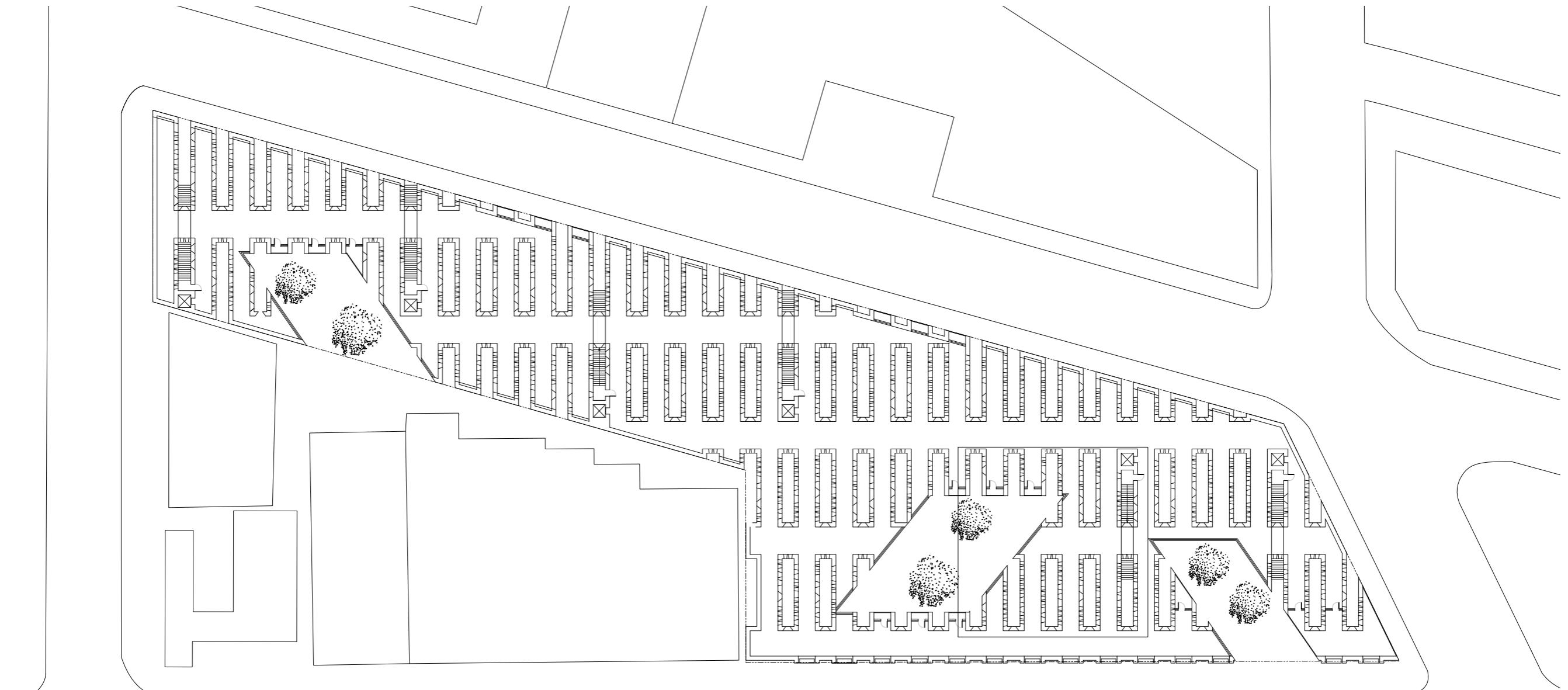
Columbarium

[Overall Design]

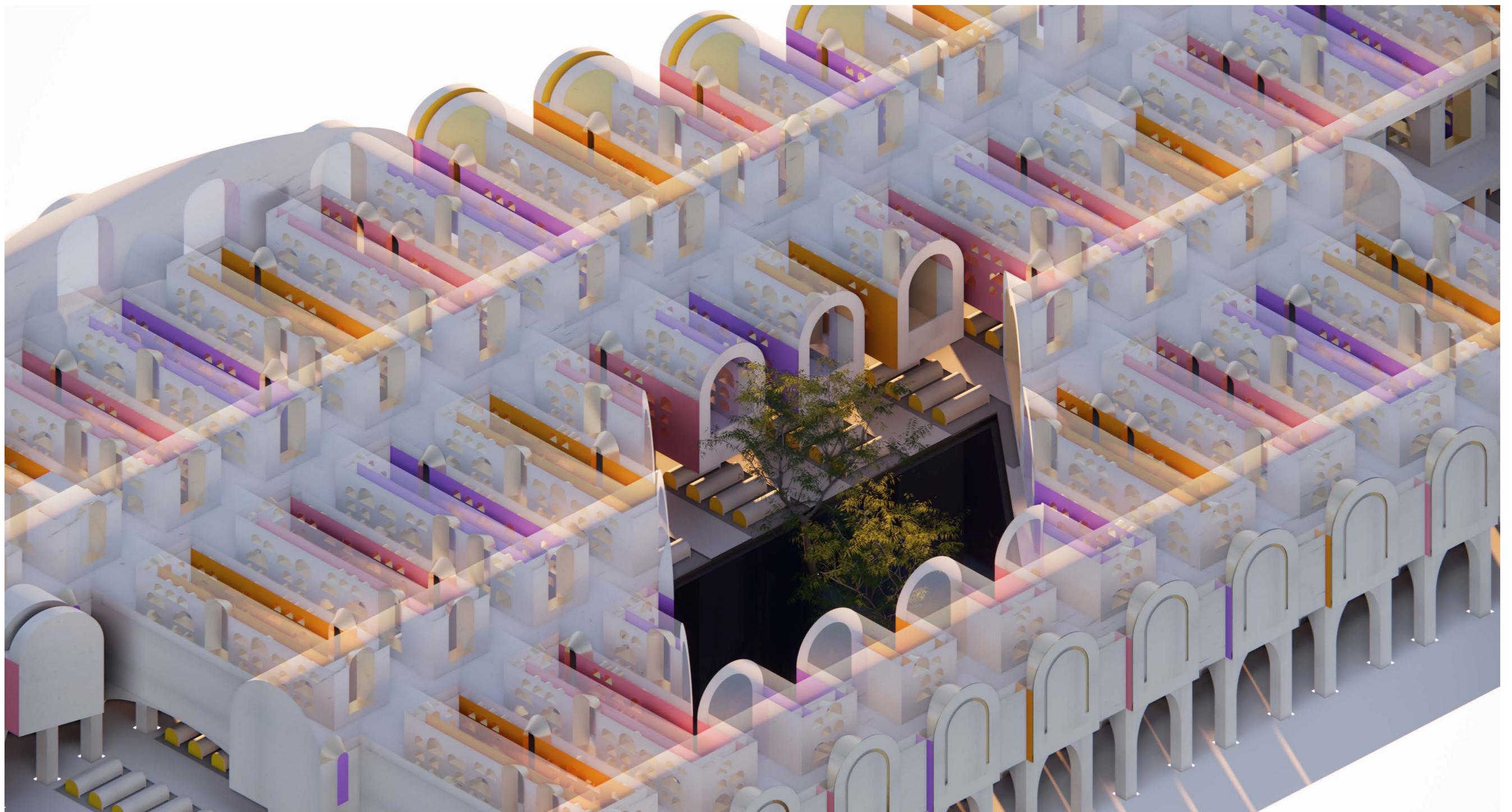
The columbarium is a repetitious grid of niche walls and light wells. Again, the deceased are in the most celebrated part of the building, washed in sunlight. Urn and window seat niches have splayed openings, taking advantage of the thick concrete walls to reflect more light into the interior. The form of this building is highly repetitive, allowing for niche density and equality. Every niche has special backlighting and all of the walls have composed compositions of arched openings. With intersecting arches for larger families



Enlarged Ground Floor Plan - Columbarium



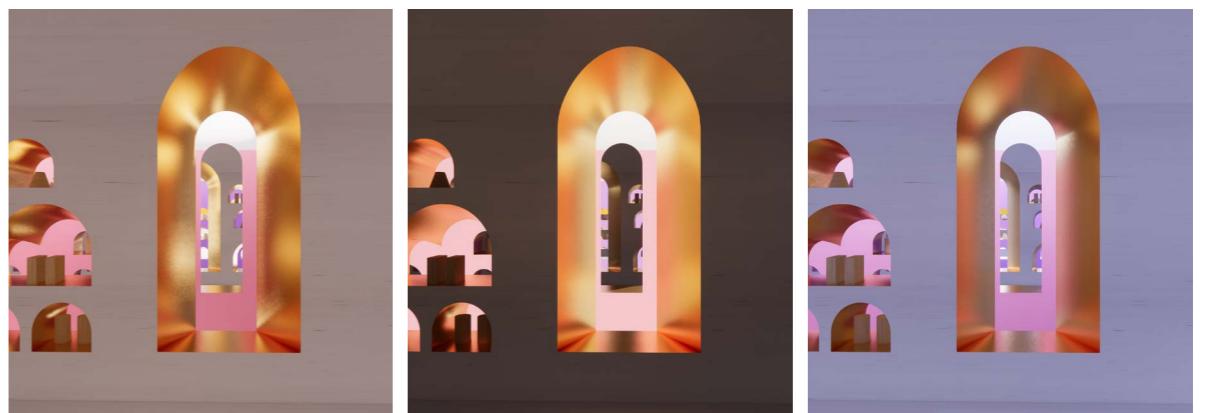
Ground Floor Plan - Columbarium



Columbarium

[Color and Time]

Openings beyond create a layered effect of different colors, specularity, and positive/negative forms. In the morning, the window seats glow with mysterious color reflecting on the metallic surface. The rhythm of eastern sunlight patterns the barrel vault walkway. Midafternoon, sunlight washes over the painted yellow wall, creating a crescent shaped outline of sunlight. Pink and purple modulates over the metallic window seat, contrasting with the yellow wall beyond. Near sunset, warm light mixes with the color walls and metallic surfaces, channeling an orange glow throughout the space. Beams of light spill from the colored glass openings.



Niche Rendering | 8am, 1pm, 8pm







Conclusion

[Overall Thoughts]

Applied color and specular finishes transform this concrete building into a sacred space for everyday interaction with death, a place to walk amongst sarcophagi and urns, a place to pause, contemplate, mourn with saturated color, light and shadow.

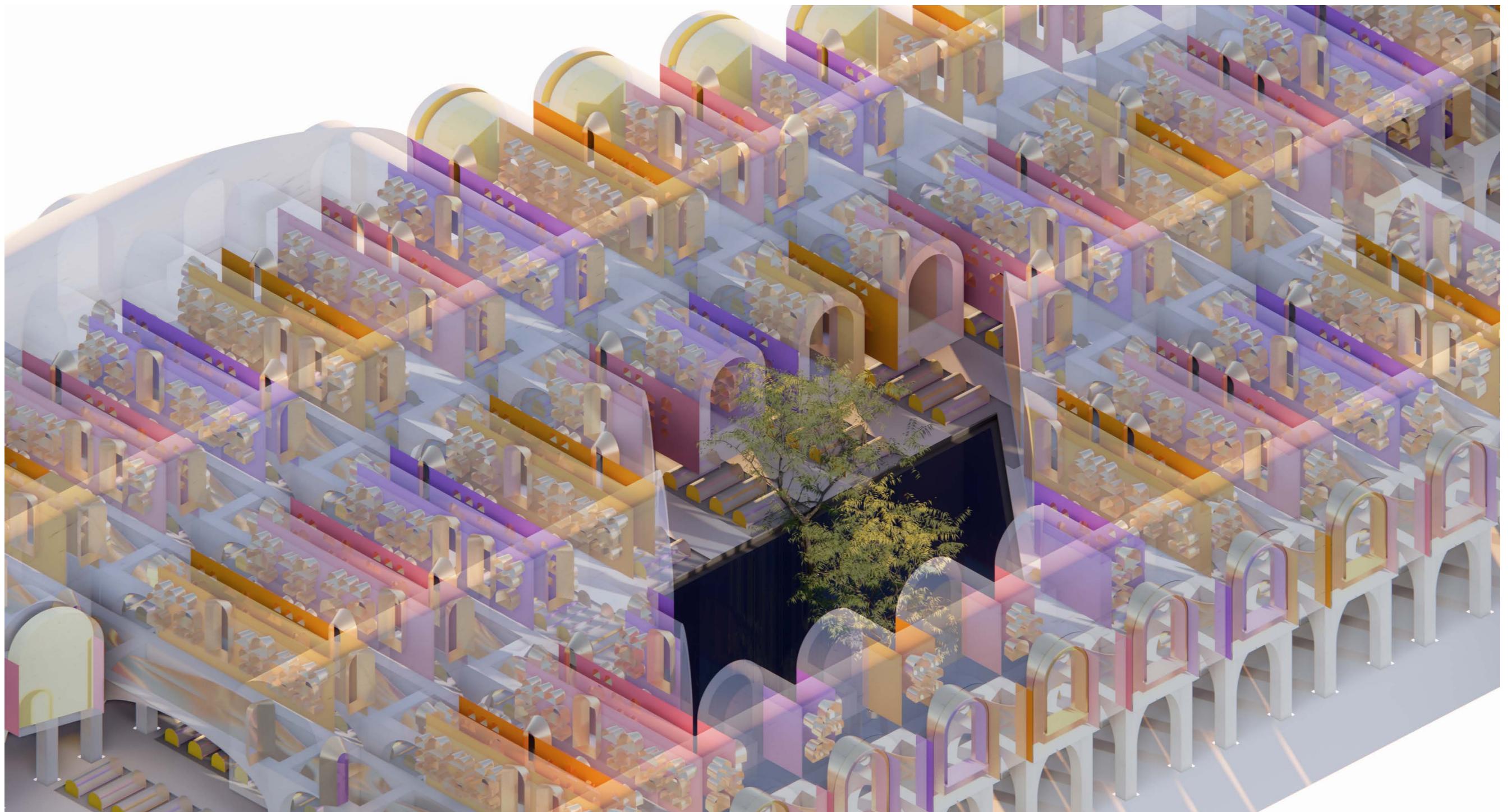
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[Bibliography]

Aguilar, Cristian. "The Color Inside / Overland Partners + James Turrell Skyspace." ArchDaily, ArchDaily, 28 Oct. 2014, www.archdaily.com/560974/the-color-inside-overland-partners-james-turrell-skyspace?ad_medium=gallery.

Aguilar, Cristian. "The New Crematorium, The Woodland Cemetery / Johan Celsing Arkitektkontor." ArchDaily, ArchDaily, 22 Sept. 2014, www.archdaily.com/547748/the-new-crematorium-the-woodland-cemetery-johan-celsing-arkitektkontor.

"Ahead of the Curve." The Guardian, Guardian News and Media, 17 Mar. 2007, www.theguardian.com/books/2007/mar/17/architecture.modernism.

Alarcón, Jonathan. "Crematorium Baumschulenweg / Shultes Frank Architekten." ArchDaily, ArchDaily, 10 Nov. 2020, www.archdaily.com/322464/crematorium-baumschulenweg-shultes-frank-architekten.

Architects, Steven Holl. "CHAPEL OF ST. IGNATIUS." STEVEN HOLL ARCHITECTS, www.stevenholl.com/projects/st-ignatius-chapel.

"Archiweb - Woodland Chapel." Archiweb.cz, www.archiweb.cz/en/b/lesni-kaple.

Bachelard, Gaston. The Poetics of Space. Penguin Classics, 2014.

Behance. "Water Temple." Behance, www.behance.net/gallery/42715619/Water-Temple.

Chapel of the Chimes Oakland, oakland.chapellofthechimes.com/.

City Cremation, 30 Jan. 2020, citycremation.com/.

Colors of Dia De Los Muertos, sddayofthedead.org/colors.htm.

Corbusier, Le, and Kenneth Hylton. Le poème De L'angle Droit ; Fondation Le Corbusier, 1989.

"Erik Gunnar Asplund: MoMA." The Museum of Modern Art, www.moma.org/artists/27?&undefined.

"Facilities." Pacific Interment Mortuary and Crematory Service, 30 Apr. 2020, interment.com/facilities/.

"Funeral & Burial Rituals From Around The World." Everplans, www.everplans.com/articles/funeral-burial-rituals-from-around-the-world.

Funeral Guide. "Colours of Mourning in Different Cultures of the World." Funeral Guide, [Https://www.funeralguide.net](https://www.funeralguide.net), 26 Oct. 2017, www.funeralguide.net/blog/mourning-colours.

"Funerals and Ceremonies." Center for Loss & Life Transition, 27 Dec. 2016, www.centerforloss.com/grief/funerals-and-ceremonies/.

"Funerary Architecture: Designing for Grief." DesignCurial, 24 Mar. 2020, www.designcurial.com/news/funerary-architecture-designing-for-grief-7816430.

Hu, Jane C. "Why Does the West Coast's Sky Look Like Literal Hell Right Now?" Slate Magazine, Slate, 9 Sept. 2020, slate.com/technology/2020/09/california-oregon-wildfires-red-orange-sky-glow.html.

Kite, Stephen. Shadow-Makers: a Cultural History of Shadows in Architecture. Bloomsbury Academic, 2017.

"Les Carrières." ATELIER HOPKINS, www.atelierhopkins.com/les-carrieres/be-5jv8ra97uu2ctnpzvwlze5ml80u.

"Light Therapy." Apolonija Šušterši, apolonijasustersic.com/portfolio/466/.

"Luis Barragán." Encyclopædia Britannica, Encyclopædia Britannica, Inc., 18 Nov. 2020, www.britannica.com/biography/Luis-Barragan.

O'Neil, Lauren. "Toronto Museum Getting Light Therapy Room to Combat Seasonal Depression." BlogTO, BlogTO, 14 Nov. 2018, www.blogto.com/arts/2018/11/toronto-museum-getting-light-therapy-room-combat-seasonal-depression/.

"Olafur Eliasson's Weather Project - Why Did He Try to Recreate the Sun?" Public Delivery, 4 June 2020, publicdelivery.org/olafur-eliasson-the-weather-project/.

Pallasmaa, Juhani. *The Eyes of the Skin: Architecture and the Senses*. Academy, 1996.

Pengyunxiang. "Water Temple, Tadao Ando." *Modern Architecture: A Visual Lexicon*, 12 Oct. 2017, visuallexicon.wordpress.com/2017/10/04/water-temple-tadao-ando/.

Pereira, Matheus. "The Role of Color in Architecture: Visual Effects and Psychological Stimuli." ArchDaily, ArchDaily, 9 June 2018, www.archdaily.com/895498/the-role-of-color-in-architecture-visual-effects-and-psychological-stimuli.

Phaidon. "How Louis Kahn's Drawings Changed His Architecture." PHAIDON, www.phaidon.com/agenda/architecture/articles/2014/july/14/how-louis-kahns-drawings-changed-his-architecture/.

Plummer, Henry. *Nordic Light: Modern Scandinavian Architecture*. Thames & Hudson, 2014.

Plummer, Henry. *The Architecture of Natural Light*. Thames & Hudson, 2012.

Saih, Nico. "Tanatorio Municipal De Leon / BAAS." ArchDaily, ArchDaily, 19 July 2008, www.archdaily.com/3891/tanatorio-municipal-de-leon-baas?ad_medium=gallery.

Sarah Kessler Writer. "Mexican Funerals: Traditions, Customs & What to Expect." Cake Blog, www.joincake.com/blog/mexican-funeral-what-to-expect/.

Savinon, Ivan. "A Look Inside the Life of an Iconic Modern Architect: Alvar Aalto." - Architecture. Design. Art., 2 May 2017, mads.media/look-inside-life-iconic-modern-architect-alvar-aalto/.

Schielke, Thomas. "How Luis Barragán Used Light to Make Us See Color." ArchDaily, ArchDaily, 12 July 2018, www.archdaily.com/898028/how-luis-barragan-used-light-to-make-us-see-color.

Schielke, Thomas. "Light Matters: Heightening The Perception Of Daylight With Henry Plummer (Part 1)." ArchDaily, ArchDaily, 3 May 2015, www.archdaily.com/626181/light-matters-heightening-the-perception-of-daylight-with-henry-plummer-part-1.

Schielke, Thomas. "Light Matters: Louis Kahn and the Power of Shadow." ArchDaily, ArchDaily, 23 Apr. 2013, www.archdaily.com/362554/light-matters-louis-kahn-and-the-power-of-shadow.

Schielke, Thomas. "Light Matters: Sacred Spaces." ArchDaily, ArchDaily, 28 Mar. 2014, www.archdaily.com/490781/light-matters-sacred-spaces.

Schielke, Thomas. "Light Matters: Seeing the Light with James Turrell." ArchDaily, ArchDaily, 4 June 2013, www.archdaily.com/380911/light-matters-seeing-the-light-with-james-turrell.

"Sigurd Lewerentz, Gunnar Asplund, Chen Hao · Woodland Cemetery." Divisare, divisare.com/projects/347973-sigurd-lewerentz-gunnar-asplund-chen-hao-woodland-cemetery.

Tanizaki Jun'ichiro. *In Praise of Shadows*. Leete's Island Books, 1977.

"Tomb." Encyclopædia Britannica, Encyclopædia Britannica, Inc., www.britannica.com/topic/tomb.

VILLE KOKKONEN OFFICE FOR INDUSTRIAL DESIGN GmbH., www.villekokkonen.com/work/bright-white-1/.

"Water Temple." Architectuul, architectuul.com/architecture/water-temple.

"Why Is the Funeral Ritual Important?" Center for Loss & Life Transition, 16 Dec. 2016, www.centerforloss.com/2016/12/funeral-ritual-important/.

"What Is the Penumbra?" Timeanddate.com, www.timeanddate.com/eclipse/penumbra-shadow.html.

"Woodland Chapel by Erik Gunnar Asplund at GreatBuildings." GreatBuildings, www.greatbuildings.com/buildings/Woodland_Chapel.html.